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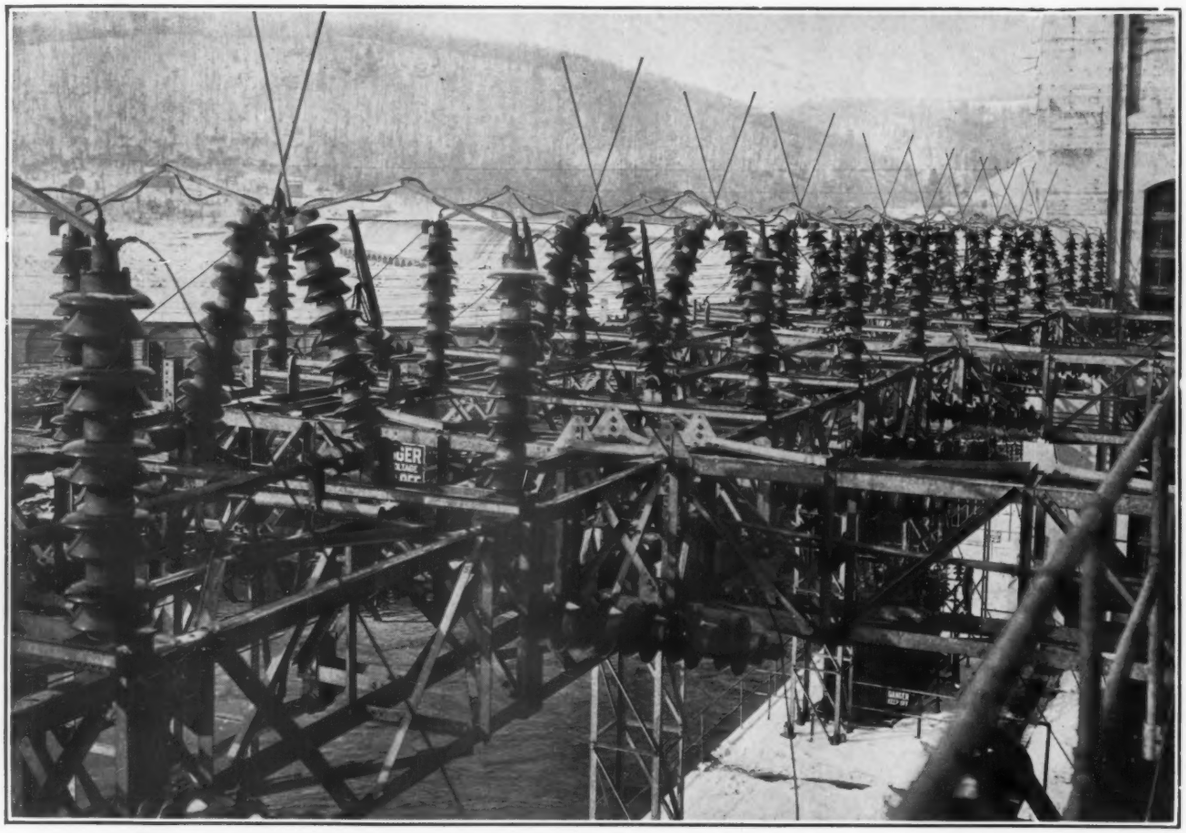

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Contents

Editorial 187

The Paramount Fact Revealed by the St. Francis Dam Disaster—Prompt Adjustment of Misunderstandings Will Check Growth of Serious Differences—The New Competition—Distribution is the Real Problem—Employment of Existing Distribution Channels Versus Creation of New—Less Talk and More Work Will Bring Recognition to Commercial Men—The Consolidation in Portland—Research Laboratories Are Crucibles of Progress—Why All the Secrecy?

Dam Failure Wrecks Power Systems 190

A presentation of authentic information regarding Southern California's greatest disaster and an engineering discussion of pertinent facts and figures that have been obtained from several reputable and well qualified channels and sifted with utmost care.

All That Remains of Great Storage Reservoir ..... Facing page 192

A pictorial insert showing clearly some interesting facts pertaining to the St. Francis collapse.

Spreading the Farm Electrification Idea 194

By L. W. BRAINARD

The benefits accruing from the use of electricity on the farm were brought to the attention of Idaho and Oregon farmers through well planned exhibits and educational efforts in conjunction with regional agricultural fairs. This tells and shows how it was done at a profit.

Glines Plant Under Supervisory Control 196

A 13,333-kva. hydro-electric plant built in northwestern Washington to serve primarily a paper-mill load is described. The plant is remotely controlled from an older generating plant farther downstream.

Setting Up Electrical Standards for Fresno Schools 199

The trend of present construction still is painfully behind modern standards of adequate artificial illumination, but the Fresno studies and application of school-room lighting described in this article show what can be accomplished with intelligent and well-directed effort, especially when coupled with a willingness to learn on the part of designer and builder.

Combined Light and Suction-Fan Trap for Insects 204

By W. B. HERMES and R. W. BURGESS

Possible relief is in sight for lakeside communities where the inhabitants suffer personal damage and discomfort from mosquitoes and other swarming insects. The authors describe methods and equipment used in a most interesting series of experiments in trapping such insects in large quantities.

Plowing With Electricity in Italy 206

"Electroculture" is the term applied in Italy to the extensive and intensive application of electricity to agricultural activities. Information presented in this article describes the machinery devised for electric plowing and shows some interesting cost figures.

Engineering Practice 208

Circulating Water Tunnel Built in Four Sections 208
Test Data on Edison 3-Wire System Shows Operating Advantages 210
Analysis of Current Transformer Tests—XI 212
Static-Stability Limit Increased by Regulating Equipment 212
Double-Range Ammeter for Ground Currents 213
Nomograph for the Determination of Voltage Drop in Conductors 214
Underground Cable Creepage Eliminated by Flat-Grade Duct Lines on Hills 214

Ideas for the Contractor 216

Circuit Breaker Enters the Residential Field 216
Outline of California Electragists' Activities 217
Theater Emergency Lighting—the "Why" for the Rules 218
Bus Bar Service to Switchboard 221
Fuse Blocks Save on Switches 221
Oil Heater Devised Using Strip Heaters 221
Calculation of Wire Sizes for Frequency-Changer Installations 222
Special Applications of Electric Ventilating 223

Better Merchandising 224

Percolator Sales Can Be Perked Up 224
Illuminated Signs on Red Seal Display 225
Lighting of Portland Utilities Building Sets Example 226
Co-operating and "Swap" Range Campaigns Prove Profitable 228
Making a Survey of Merchandising Possibilities 230

News of the Industry 232

Contractors, Dealers and Inspectors 240

Personals 243

Meetings 244

Manufacturer and Distributor 245

New Equipment 246

Industrial Barometer 248

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The Paramount Fact Revealed by the St. Francis Dam Disaster

FAILURE of the St. Francis dam and the ensuing flood brought a terrible disaster to the inhabitants of the Santa Clara River Valley. The detailed description elsewhere in this issue, based upon close personal investigation by Dr. Nathan A. Bowers, Pacific Coast editor of *Engineering News-Record*, tells the story from an engineering standpoint. To the relatives and friends of the nearly three hundred victims, and those survivors whose homes and means of livelihood have been swept away, heartfelt sympathy is extended.

It should be possible to extract something of good from this great tragedy, some lesson dearly bought, that never again shall such a catastrophe be brought about.

In studying the situation, it appears that, to say the least, bad judgment was displayed both in the selection of the site for the dam, and in apparently disregarding the character of the stratum of material against which the wings abutted. These conditions will be analyzed by the many investigating committees in due time and will be covered by their reports, and responsibility for the disaster placed where it belongs.

In the meantime, one fact stands out above all others —that California municipal institutions, such as the Los Angeles Bureau of Power and Light, are responsible to no one. There is neither independent check nor reviewing authority for any of their projects. The California statute of 1917 specifically exempts from supervision by the state engineer's office structures built by the California State Debris Commission, certain irrigation districts directly under the regulation of the engineering division of the California Railroad Commission, and municipal corporations maintaining their own engineering departments. The Federal Power Commission is without jurisdiction unless public lands are involved. The California Railroad Commission is also without jurisdiction.

Why the trend of legislation should recognize the element of human frailty and provide independent safeguards in the case of men in the employ of private corporations, and apparently invest with infallibility a municipal corporation, is difficult to understand. That an independent reviewing authority, far enough away to be free from local or other influences, is an essential safeguard in the case of any engineering structure would appear to be self-evident, as is also the folly of exempting municipal corporations from such provision.

Now that the disaster has occurred, there is real danger that through popular clamor the pendulum will be swung to the other extreme. If history is about to repeat itself, a mass of restrictive legislation is likely to be forthcoming that will impose such onerous rules and regulations as to become a real stumbling block in the path of progress. There is abundant law already in existence. That the law should extend to everybody, private utility and municipal corporation alike, cannot be gainsaid. And ways and means should be provided by which municipal corporations should be subject to the same financial responsibility, both as to loss of life and property damage, as extends to private corporations. Let us hope for sane, clear thinking on the part of those in authority by which some good may arise from the failure of the St. Francis dam.

Prompt Adjustment of Misunderstandings Will Check Growth of Serious Differences

PEACE is always possible through negotiation. Little misunderstandings have a tendency to become magnified into large issues if permitted to grow without restraint, and it is a real test of leadership to take the proper action when such incidents occur. Here is a case in point:

At a meeting of the advisory committee of the California Electrical Bureau held in Los Angeles a few weeks ago it was determined that all the influence of the industry as a whole should be enlisted in building a larger membership for the Electragists. When a subsequent meeting of representatives of all branches of the industry took place in San Francisco it developed that some misunderstandings had arisen in the field between certain contractors and power company salesmen. These misunderstandings presented all the earmarks of what might become a serious situation if permitted to grow without restraint.

Then came a small conference between power company officials and the Electragists, at which it was brought out with perfect clarity that both were in hearty accord in all matters of policy, and that the acts complained of were those of individuals who had failed to achieve a proper understanding of the policies they were supposed to interpret.

The last act took the form of a joint meeting of all the district and divison managers and sales managers of the Pacific Gas and Electric Company and the Great Western Power Company, plus a generous quota of representative Electragists, manufacturers and jobbers. As reported elsewhere in this issue, policies of the power companies were clarly reiterated by R. E. Fisher and R. A. Sharon, and the addresses of C. J. Geisbush for the Electragists, R. M. Alvord for the manufacturers and Fred Todt for the jobbers emphasized anew that there was no ground for dissension in any particular, and further that breaches of policies on the part of anybody concerned would be corrected as quickly as possible.

A more intimate contact between power company officials and Electragists in the field will operate to adjust complaints promptly and effectively. People who know one another and who through occasional friendly contact have an opportunity to exchange views and discuss their mutual problems, will get along better and better as that contact increases. The industry has too big an opportunity to waste time and energy in petty bickering. Fundamentally everybody is in accord; what is needed is a more tolerant attitude toward one another, and a better understanding of the other fellow's viewpoint.

The New Competition

AS OUR industrial life develops it progresses, and progress enevitably means changed conditions. Progress starts with improved production methods. The individual craftsman is succeeded by quantity production, made possible by standardization, automatic machine tools, and the substitution of power-driven machinery for hand labor.

As production increases, individual manufacturers must expand their markets. The local concern of yesterday becomes the national and international competitor for business of today. It is but a short time ago that competition was intra-industrial—that is, producers of similar products were fighting vigorously with one another for a greater share of the available business. Spurred on by urgent necessity while they were weakening themselves through the vigorous operation of the old law of the survival of the fittest, still another and even more vigorous competition arose.

Substitutes in the form of various synthetic products challenged established materials for many purposes. The shingle of yesterday was wood. Now we have copper, paper-product and asbestos substitutes, with many patent roofing manufacturers clamoring for a share of the business. The same is true in many other lines of manufacture.

In self-defense, manufacturers of similar lines are now banding together. They are forgetting their intra-competitive differences and animosities in the face of the threat of substitutes that, if successful, will put them out of business altogether. So we have the new, greater competition of industry versus industry, titanic groupings under one banner against other groupings, other banners. Not that each individual within the group is no longer "scrapping" with his neighbor, but each is putting up at least two fights, one through his association for the purpose of furthering his own industry as a whole, and the other to maintain his place within that industry.

Distribution Is the Real Problem

PRODUCTION capacity has increased so much, due to improved manufacturing methods, that it would seem at least as though a temporary ultimate had been reached in that direction, but as to marketing methods —that is another story. In entirely too many lines industry seems to have learned little or nothing in the last twenty-five years about marketing. The same old story, the perpetuation of old customs and traditions, is still the order of the day, except in a few instances.

The mail-order house, once an experiment, is now an established fact, and the chain store, whether one likes it or not, is another. The colossal growth of the Bank of Italy, with its tentacles stretching across the entire continent of the United States, would appear to promise the achievement of chain-store marketing of money.

While it is admitted that everything is not susceptible to the chain-store method, the fact remains that today goods are no longer merely bought. They must be sold, and the man or men who can devise marketing methods by which the cost of selling can be reduced as skillfully and efficiently as production costs have been lowered is the one who will get the larger slice of the consumer's dollar.

Other things being equal, price is the determining factor, and, unfortunately, low prices often blind the eyes of the purchaser to considerations of quality and service. The greater use of educational advertising by which the service factor is brought home to the consumer is essential, while greater volume obviously distributes overhead into more units at a lower cost burden per unit.

All of these conditions serve to ephasize more and more vigorously the necessity for market determination, analysis of buying habits, channels of approach, and the type of appeal best suited to the needs of the consumer in terms of the product offered for sale. With this background, the marketing problem may be tackled with a degree of certainty heretofore conspicuously lacking in the old hit-or-miss methods. Many markets are oversolicited to the point of being unprofitable, while other markets offering far greater possibilities go begging through the lack of intelligent market determination.

Employment of Existing Distribution Channels Versus Creation of New

NO DIAGNOSTICIAN can write a prescription applicable to all conditions. Nevertheless, there has been too much duplication of effort in marketing. Manufacturers in many cases have set up their own district organizations when the available market was not large enough to warrant such expenditure.

The existing machinery of distribution should always be studied and employed, if possible, rather than that the costly experiment of a top-heavy sales force be indulged in when available volume of business will not justify it. There is entirely too great a tendency on the part of Eastern sales managers to attempt to establish Western connections by letter and telegram from their point of vantage on a swivel chair, without even taking the trouble to journey West in person and make a real study of local conditions. And not infrequently those who do come devote prehaps a week to the 2,000 miles of the Pacific Coast, and acquire a greater familiarty with the local golf courses than with trade channels and customs.

The prescription can be written only for the individual case. Even then it cannot be expected to be efficacious unless all the symptoms have been studied and a clear-cut analysis of the situation has been made. The principles may remain the same, namely, market determination, buying habits, channels of approach and type of appeal, but their application must be individual and in proportion to the factors affecting each one.

The New Competition will not yield to haphazard attack. It must be met on its own ground and with its own weapons—intelligent concerted action.

Less Talk and More Work Will Bring Recognition to Commercial Men

TOO MANY commercial men in the industry still are wondering and talking about what can be done to gain the same measure of executive support that has made possible the splendid engineering, public relations and accounting achievements of the light and power companies. Granting that the immediate problem in market development is to secure the interest and backing of the chief executives, talk and palaver at committee meetings and conventions will not be very effective in bringing the executives into closer touch with sales problems and sales plans.

Certainly the job of putting washing machines, vacuum cleaners, ironers, percolators, toasters, refrigerators and ranges into the millions of wired homes that do not enjoy the comforts and conveniences furnished by these appliances is a big one. It cannot be accomplished over night or in a month or in a year.

Suppose tomorrow the chief executives were to approve of a huge national advertising campaign designed to popularize these appliances, would the commercial men be organized to take advantage of this publicity? They would not.

The size of the market-building and load-building job seems to have over-awed many of the commercial men. They think, "Big job, big campaigns, big sales force, big appropriations," and then go to the executives with a plan that is so huge as to look impossible of execution.

It would seem that the saner program would be to undertake load-building and marketing activities within the scope of the means available. More work and less talk should be the motto. With a record of results based upon small undertakings the commercial man is armed with a spear that will pierce the present armor of executive indifference. Greater support can then be gained for the next season or the next campaign. Soon the cumulative results will be such as to warrant and deserve the same measure of commercial enterprise on the part of the electrical industry for electrical appliances that has popularized the phonograph, the radio, the automobile and the camera in the home.

No amount of self-pity or self-sympathy will make this possible. Courage, self-reliance, initiative and good hard work will bring the commercial man the executive recognition and support that he deserves.

The Consolidation in Portland

TWO thoughts intrude themselves at once into a consideration of the proposed consolidation of operating companies in Portland. In the first place, a concrete example of an old first principle of utility operation rises again to support the theory that the business is a natural monopoly best conducted by one company in a given field, under regulation protecting the user of the service and the investor. For a time it appeared that this theory might be discarded as one outworn through changing economic conditions, in which competing companies argued that the added stimulus of competition kept each so much more active in business development that ultimately there was created a situation better than that in which one company, ungoaded by a rival, became apathetic as to new business and lazy as to service. Evidently the Portland companies, if they ever seriously supported the second and newer theory, have abandoned it for the earlier one. They know that operating economies can be effected since they make rate reduction based on such economies the *sine qua non* of the consolidation; and also it is apparent that they confidently hope the stockholders, too, eventually will benefit.

The second thought about the consolidation has to do with the desire of the companies concerned to effect it only after its ratification by the people of the community. Approval of the plan by the people will start the consolidated company out in life with a welcome vote of confidence from its patrons. This should have the effect of banishing for a considerable period of time whatever spectre of municipal ownership may have hovered over the Portland situation. The rate reduction, based on the operating and capital economies effected, will have a deeper significance to the industry at large in that the Portland consolidation will be used as an example by those communities importuned to enter the power business in competition with an existing company or to grant a competitive franchise on the ground that competition is the life of trade.

It is hoped that whatever opposition develops will be offset by the thinking citizens who see the logic of the contention that duplication makes waste, who recall the long record of unbroken promises of the two executives involved, who have faith in the principle of state regulation, and who will go to the polls with the determination not to block a forward-looking movement in the development of their city.

Research Laboratories Are Crucibles of Progress

MOST of the niceties of life that have raised the standard of living of this present era of civilization are products of the research laboratory. The same holds true of many of the present-day necessities that but a few years ago were considered luxuries. And it is to the research laboratory that the public must look in the future for products that will make life even more worth while.

No better insight into what the future holds can be obtained than by visiting almost any one of the two hundred and seven industrial laboratories or one of the one hundred and forty-three research laboratories of the colleges and universities of the country. A visit to any one of the Western universities where research is under way will demonstrate the trend. For instance, at Stanford University a few weeks ago an ELECTRICAL WEST editor watched electrical discharges of 2,100,000 volts in the Ryan Laboratory. The research under way was incident to the study of high-tension transmission. In the aeronautic laboratory a gale of ninety miles an hour was produced in a wind tunnel. Airplane propellers and fuselages were being studied for the purpose of making air transportation faster and safer. In another testing laboratory was a shaking table for studying the effect of earthquakes on various types of structures. Electric furnaces capable of producing temperatures up to 3,000 deg. C. were available for experiments with alloys and enamels. These were but a few of the research studies under way.

Similar conditions prevail in other laboratories throughout the country. From the results will come the new products and services of the next generation. Just as much of the progress of the electrical industry during the past two decades has been the result of research studies, so will future progress be based upon experiments now under way.

Why All the Secrecy?

GEORGE E. LEWIS, of the Rocky Mountain Committee on Public Utility Information, Denver, asked that question of the utility executives in attendance at the convention of the New Mexico Utilities Association reported elsewhere in this issue. Following that question here are some of the things he said:

"For years we have been attending gatherings like this and have passed on numerous valuable ideas that have made for better service, yet when we go back to our respective towns you would think that our deliberations were in secret, that we had been attending a tar and feather party, so far as letting our employees in on what we have learned is concerned. You can't expect employees to ferret out policies as they would a murder mystery. You can't expect them to deal with the public as we would have them do unless we tell them how."

Observations so pithy need no amplifying comment. It might be added, however, that the condition of which Mr. Lewis speaks is not confined to New Mexico.

Dam Failure Wrecks Power Systems

St. Francis Debacle at Once Exemplifies Poor Foundation and Vindicates Gravity Type Dam

WHEN the St. Francis dam of the Los Angeles municipal aqueduct system gave way at midnight, March 12, it completely demolished a 35,000-kw. hydro-electric generating plant, put out of commission two other plants totaling 46,000 kw., caused three serious breaks in the aqueduct system, washed out two 110-kv. transmission lines, two 220-kv. transmission lines, put out of commission an important transmission and switching center, washed out highway

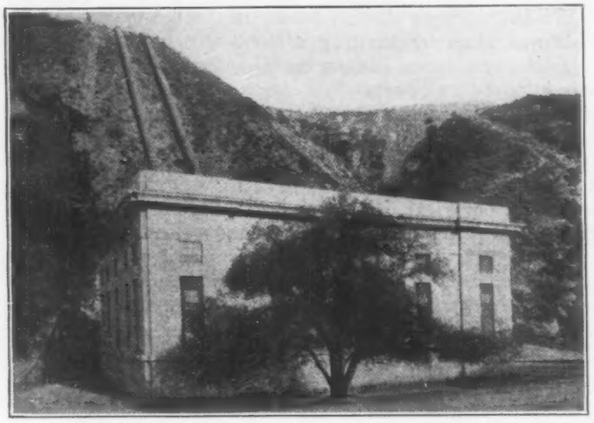


Fig. 1. San Francisquito No. 2 hydro plant of the Los Angeles Bureau of Power and Light, 1½ miles downstream from the St. Francis dam, as it appeared before the disaster. The building was a reinforced concrete structure standing about 60 ft. high.

and railroad bridges, and last, but by no means least, brought death and millions of dollars of property damage to six or eight small towns throughout the Santa Clara River Valley in Ventura County, Calif. The toll in human lives and in property damage had not been fully determined when this article was written on March 22, but at that time the total fatalities were believed to be in excess of 300. The casualty list was heavy because of the parallel facts that sections of the great dam structure collapsed practically all at once and without warning, and that it collapsed at midnight when residents in the valley below were asleep and with only limited opportunity for escape.

The St. Francis dam was a concrete gravity-type structure, arched in plan, but depending entirely upon its gravity section and foundation anchorage for stability. It was in San Francisquito Canyon, approximately 45 miles northwest of Los Angeles and perhaps 11 or 12 miles north of Saugus between San Francisquito plants No. 1 and No. 2 of the Los Angeles Power Bureau's aqueduct system. Ten or eleven miles below the dam San Francisquito Canyon empties into the Santa Clara River (Ventura County) which drains westerly about 50 miles to the ocean, passing through Piru, Fillmore, Santa Paula and several other small cities.

"Highline Bumps" First Warning

According to the Southern California Edison Company, the first warning of the impending disaster came when that company's 60-kv. transmission line between Saugus substation (14 miles downstream from the dam) and Lancaster went out of commission at 11:58 p.m. Inasmuch as this line crossed the San Francisquito Canyon over one end of the St. Francis dam, the failure of that line fixes rather definitely the time of the actual dam break. At 12:02 a.m. both of the Los Angeles Power Bureau's 110-kv. transmission lines from its San Francisquito hydro-electric plants went out coincident with the destruction of San Francisquito No. 2 plant, about a mile and a half downstream from the St. Francis dam. The power house together with the living quarters of the operating force was completely demolished without warning. At 12:39½ a.m. one of the Edison company's two 220-kv. Big Creek lines went out of service north of Saugus substation and at 12:41 a.m. the second line also went out as the flood waters undermined the transmission towers. Almost immediately thereafter the Saugus substation itself suffered partial inundation which put it out of commission.

Up to this time the dispatching offices of neither the Los Angeles Power Bureau nor the Southern California Edison Company knew what was causing the outages. Shortly before 1 a.m. an Edison patrolman stationed near Saugus, 12 miles downstream from the dam, extricated himself from the flood in which he had been caught and turned in a warning to the Edison dispatching office via telephone. Immediately the dispatching office used all available communication channels to reach substations lying in the Santa Clara River Valley in the path of the onrushing flood, in order to arouse the operators to assist in warning the various local communities.

The St. Francis reservoir had a capacity of 38,000 acre-ft. and was practically full at the time of the

Fig. 2. All that remains of the power house shown in Fig. 1. One of the two 17,500-kw. units probably will be salvaged. The other unit was operating at the time the plant was destroyed and apparently ran for some time afterwards, without its governor and sans lubrication, with the result that its bearings were destroyed and the machine largely wrecked by the resulting excessive vibration.

break. The flood reached Santa Paula, 46 miles below the dam, at 3:10 a.m., thus averaging about 15 miles per hour in its advance. Rough estimates based upon observation of the rate of flow, upon channel sections and upon the apparent average velocity indicate that the flood exceeded 450,000 sec.-ft. at Santa Paula. By 6 a.m. the flood had subsided to a small amount representing bank storage and return waters. In the San Francisquito Canyon itself, which is much narrower and more precipitous than the Santa Clara River Valley, observations and data available indicate that the flood in that canyon amounted to about 800,000 sec.-ft. In the canyon itself this represented a virtual wall of water anywhere from 75 to 125 ft. in height.

Gravity Dam

The dam was designed as a gravity section without considering any arch action, with pressure allowance at the toe limited to 10 tons per sq.ft. and at the heel to 12 tons per sq.ft. Concrete was taken at 140 lb. per cu.ft. and allowance was made for uplift due to water pressure. The maximum section, a sketch of which is shown herewith, was 205 ft. high, 176 ft. thick at the base, and arched on a radius of 500 ft. Excavations for the foundation of this dam extended 30 ft. below the stream bed at mid-channel and to lesser depths at higher elevations. The foundation material is of two sorts that meet on a well defined plane about 50 ft. above the stream bed and which may be picked out readily in the accompanying illustrations. The rock underlying the stream bed and on the left bank is rated geologically as schist, but is locally known as graywacke shale. The right bank above the contact plane is referred to usually as a red conglomerate; this material obviously was not of the best quality, but nevertheless it was accepted as a suitable foundation for the dam and excavations were made deep enough to provide what was considered a safe anchorage and what undoubtedly would have been a safe anchorage had the foundation material been of good quality.

No grouting of foundations was done, but it was stated that in the stream bottom holes were sunk from 20 to 30 ft. deep on 10 or 12-ft. centers in the foundation trench about 15 ft. back from the upstream face of the dam. Four-in. pipes were brought out of these holes and led through a common drain outlet in the downstream face at streambed level.

H. A. Van Norman, assistant chief engineer of the Los Angeles Bureau of Waterworks and Supply, stated definitely to a McGraw-Hill staff representative that he and William Mulholland, chief engineer, personally visited the St. Francis dam the day before the break and that they had observed the seepage beneath and

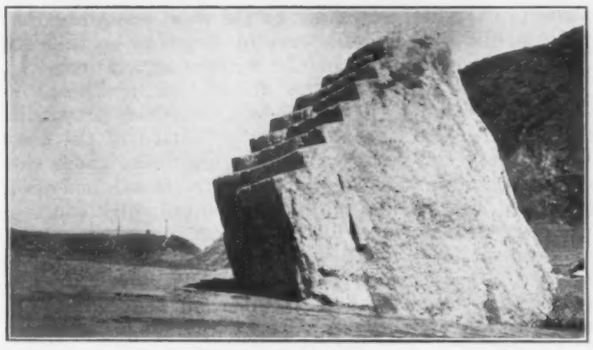


Fig. 3. A piece from the dam measuring 30 x 40 x 50 ft. above the ground and no one knows how much beneath the debris in which it is lodged. This dam section weighs more than 5,000 tons and was carried downstream several thousand feet. The wing dam flanking the St. Francis dam may be seen on the skyline to the left of the concrete block.

around the dam and had found no signs that might indicate danger to the structure.

Only a 100-ft. length of the dam remained standing after the catastrophe, a portion near the center of the dam. This erect section withstood the shock and vibration of having both ends of the dam wrenched away from it and still is standing apparently in its original positon. This is borne out by the fact that at the base of its right-hand side where the stream eroded 15 or 20 ft. beneath the foundation, there is no sign of crushing in the underlying material such as would have been almost certain to result if movement had occurred. See accompanying insert.

The section of the dam that remained standing contains the gate house in which there was installed a recording depth gage which was supposed to have been operating satisfactorily at the time of the break. Up to the time that this article went to press this gate house and recording gage, perched high on top of the central erect 200-ft. section of dam, had not been reached, but it is expected that it will be reached in the near future and the depth charts brought to light. If the instrument continued to operate normally after the failure, it is expected that the charts will give an interesting record of the rate of drawdown of the reservoir.

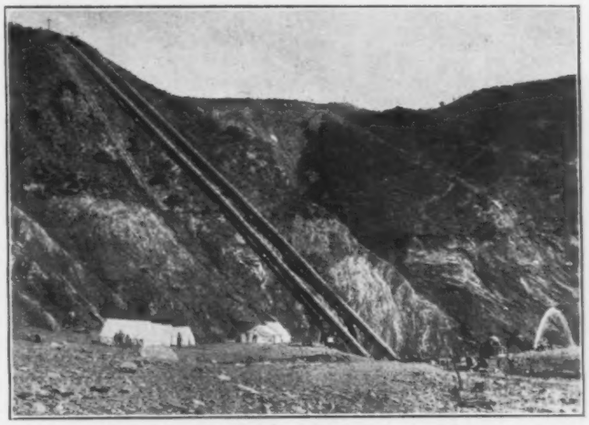


Fig. 4. Site of No. 2 power house showing the penstocks still intact. Note the "scour" line along the hillside which indicates the depth of the flood at this point, more than 100 ft. A relief camp may be noted.

To all appearances the gate house and its mechanism seem to be intact and consequently much interest centers in the possible record of the depth gage.

The dam itself contained no vertical joints as definite provision for contraction because it is not the policy of the Los Angeles Bureau of Water Works and Supply to make provision in dam design for contraction joints, but rather it is the policy to allow contraction cracks to occur where they will and subsequently to close them if necessary. This procedure is followed because it is the opinion of the Bureau's engineering department that in spite of the definite provision of expansion joints, cracks are very likely to occur elsewhere anyway and it is believed that it is the better policy to allow them to occur where stresses dictate rather than to attempt to fix them by expansion joints. Of course contraction cracks did occur in the St. Francis dam in approximately radial planes, but they were not of such nature as to affect in any way the stability of the structure. In a structure of the St. Francis type it is common, according to the consensus of engineering opinion, that contraction cracks should occur approximately every 100 ft. This is borne out by the fact that the central portion of the dam that remains standing is slightly more than 100 ft. wide, indicating that perhaps contraction cracks had something to do with the exact point at which rupture occurred when the side foundation gave way, throwing the structure into action as a cantilever beam across the canyon, a stress of course not designed for in a gravity type dam. However, as before stated, contraction cracks that did occur did not affect the stability of the structure.

While it is true that the question of just exactly where the failure began and just exactly what the sequence was in the breakup of the dam probably never will be positively known, it is possible to reconstruct what appears to be an acceptably logical sequence from

data obtained through observation and first-hand examination. On both sides of the central erect portion are 300-ft. gaps originally filled in by the dam and in which now nothing remains as it was before the break. The gap toward the right bank contains no vestige of concrete, all portions from this section of the dam having been swept far downstream, as indicated in the accompanying illustrations. The gap toward the left bank is choked with large fragments from that part of the dam, all but one of which are piled up within the gap itself. The one exception is the large piece which may be seen resting against the downstream face of the erect section.

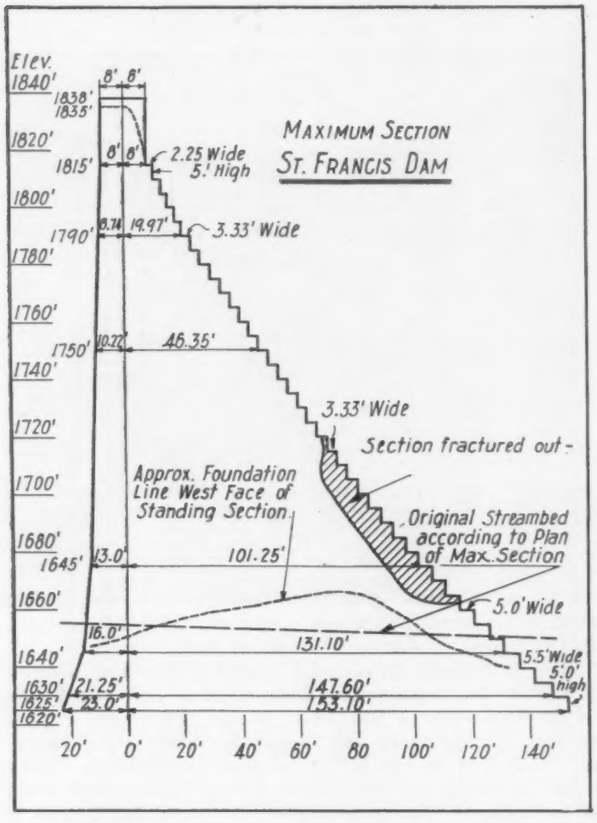


Fig. 5. Elevation at the maximum section of the St. Francis dam with sufficient dimensions given to indicate accurately the proportions of the structure. The heavy dotted line near the base of the section is the foundation line as uncovered at the west (right) face of the erect section and as shown further in Fig. 6 on the facing page and in the accompanying insert (picture 5). The shaded section represents the scaled portion of the downstream face of the standing section as shown also in the illustration in the accompanying insert.

The fact that all fragments from the right-hand gap were carried far downstream while those from the left-hand gap were moved but little would indicate that the initial failure occurred at the right-hand side of the stream. This is borne out further when it is considered that pieces of concrete up to 30 x 50 ft. in size projecting as much as 40 ft. above the debris (and nobody knows how far beneath) are strewn down the channel below the dam. None of these fragments were deposited within the first 1,000 ft. and large portions are more than a half mile from the dam.

Reconstructing further, it seems logical to expect that the back-water and whirlpools occurring immediately downstream from the dam, as the result of the flood waters rushing out of the right-hand gap, caused the cutting and undermining of the downstream foundation of the left-hand section. This coupled with heavy slides, which occurred practically at the left-hand abutment and which undoubtedly struck the left-hand portion of the dam with appreciable force, probably contributed materially to the destruction of that section. These slides apparently were occasioned by the sudden bank drainage occurring as the result of the rapid drawdown in the reservoir incident to the break.

Foundation Failure

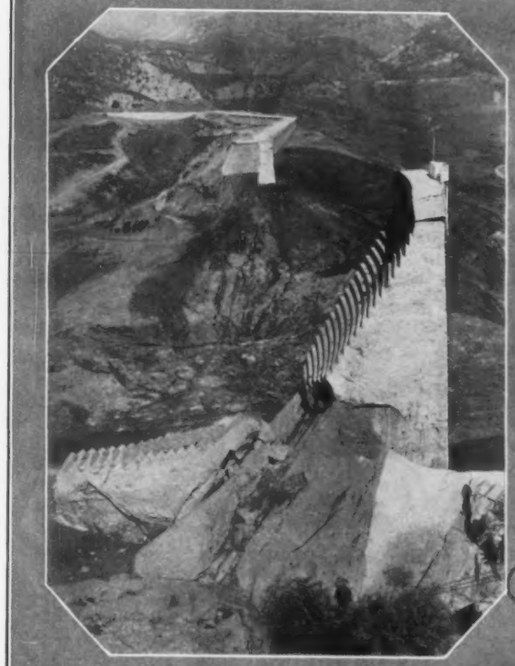
Actual cause seems obviously a question of foundation failure. This is borne out by numerous findings. Whatever the initial cause, since both ends carried away while flanked on one hand by a stable dam section and on the other hand by the abutments, it seems obvious that the ends had poorer foundation than the central section which, after all the disturbance, remains erect without support on either side. On the right bank the rock now is bared from streambed to crest level and this portion of the canyon cross-section now exposed has been eroded appreciably below the surface on which the concrete originally was poured for the dam. Just how much erosion has occurred cannot be determined without survey, but it amounted to at least 15 ft. in some places. The two distinct geological formations meet in a very definite contact plane on this right bank, about 50 ft. above the streambed. Along this contact plane is a seamy formation so softened by contact with water that it is possible to dig out the veins with the fingers.

Above this contact plane the formation has the appearance of red conglomerate, but it was found that typical samples even though hard and rock-like when dry, when submerged in water would soften within a short time to such an extent that it was possible to break them up in the hands. It is obvious that the foundation material upon which the dam was poured is not as firm now as it was before saturation, when concrete was poured on it. On the left bank the foundation abutment against which concrete was poured also appears to have been cut away by the flood, but slides that followed have covered the face of the slope so that the rock itself cannot be examined without excavation.

A striking illustration of foundation conditions is shown in Fig. 6 on page 193, a view which shows the base of the right face of the erect section of the dam. Here it is shown that rock is adhering to the under side of the concrete which still remains in its original position. In other words, the foundation on which concrete was poured and on which the dam rested has been undermined for a depth of from 15 to 20 ft. below the bottom of the original foundation excavation. This is further indication that the foundation has changed in character and quality since it was placed under water because it is inconceivable that concrete would have been poured originally on a foundation material as poor as it now is. The consensus of opinion as of March 21 among engineers who have personally examined the break was that foundation conditions at least were an important factor if not the sole cause of the break. The question of how effectively grouting would have prevented water from getting into the foundation material and how much of a factor this would have been in preventing the failure also is being discussed in engineering circles.

Reserve Domestic Storage Only

The St. Francis dam was built purely to regulate the flow of the Los Angeles aqueduct and to conserve such water as could be stored in its reservoir when the lower reservoirs were filled. The 36-sq.-mile area tributary to the St Francis reservoir was not used as a catchment basin except for flood waters, the normal runoff from that area being passed through the St. Francis



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All That Remains of Great Storage Reservoir

(1) View across canyon from left bank. (2) Close-up of erect central section. Each of the "steps" is 5 ft. high. (3) Looking upstream. Note heavy slides on left bank. Each "bay" at crest is 26 ft. wide. (4) Upstream face of dam at right edge of standing section. Note deep erosion. (5) Pieces of concrete weighing 5,000 tons were carried downstream thousands of feet. By way of comparison note the man (tiny spot) under the right edge of the piece near the center foreground.

dam to accommodate water rights further downstream. The reservoir stored water which already had passed through San Francisquito power house No. 1 and which it was not desired to pass through power house No. 2. Water released from the St. Francis reservoir for use in the aqueduct system was passed down San Francisquito Creek to a point downstream from the former San Francisquito No. 2 power house where such waters were combined with the discharge from the No. 2 power house and gathered up in the aqueduct intake to be conveyed on through the aqueduct system.

The added 100 ft. or so of head imposed upon the intake and consequently upon three conduit sections within the next 3-mile section of the aqueduct line as the result of the flood caused breaks at these points, the only damage interfering with the use of the aqueduct. To repair these breaks in the aqueduct line below the San Francisquito intake, it was necessary to draw down the Dry Canyon reservoir to a level sufficiently low to uncover the main tunnel outlet. Thus entering the tunnel through the outlet at the Dry Canyon reservoir, men and materials were transported through the tunnel to the breaks, a 2½-mile trek to the upper break. This was the only means of approach because of the complete destruction of all roads in San Francisquito Canyon.

Edison System Picks Up City Load

As a result of the complete disruption of the hydroelectric generating system of the Los Angeles Power Bureau, the entire portion of the Los Angeles City load normally carried by the Bureau's generating plants was thrown suddenly upon the system of the Southern California Edison Company with which the Power Bureau's system is interconnected. As a result of this load addition, the Edison company on Tuesday night, March 13, carried the largest peak load in its history, 500,900 kw., and for the 24-hr. period following the failure of the dam the system output of the Edison company was 8,808,564 kw.-hr., also a system record. This load was carried largely by the Long Beach steam plant supplemented by the Big Creek hydro system.

Immediately after the flood, as a result of the loss of the two Big Creek lines the only tie between the Edison company's Los Angeles system and its Big Creek plants was the new Vincent 220-kv. line which tied in with the original Big Creek lines at Magunden substation east of Bakersfield, Calif. Thus it was possible to maintain service from Big Creek in spite of the loss of the other two lines. Nine towers were torn down in the west Big Creek line and three in the east Big Creek line, almost immediately north of Saugus substation. Immediate repair efforts on the part of the Edison company resulted in the west Big Creek line being replaced in service at 5 p.m. March 16, while the east line was in operation March 19. The Edison company had 300 men on the ground at Saugus substation before daybreak on Tuesday morning, less than six hours after the dam failure, and feverish efforts on the part of this crew resulted in the re-establishment of service to Santa Clara Valley communities that same morning.

About eight miles west of Saugus substation the Southern California Edison Company had a construction camp of 178 men encamped on a mesa adjacent to the bed of the Santa Clara River down which stream the flood waters raged. Of the 178 men in that camp 42 have been found dead and 42 still are missing while 94 are accounted for as having escaped alive (as of March 21.) According to the Edison company it is estimated that the loss sustained by the Los Angeles Bureau of Power and Light in property damage will exceed $5,000,000, while the loss of the Edison company will approximate $100,000. Reconstruction work is contemplated by the Power Bureau but no definite plans have been announced as yet.

Representatives and crews of the various utility companies, the Red Cross and other agencies, did effective work in rescue and assistance in the flood stricken area, and were aided in their work by good weather. Uninterrupted communications greatly expedited rescue and repair work.

Information and illustrations entering into the foregoing article were supplied largely by Dr. Nathan A. Bowers, Pacific Coast editor of *Engineering News-Record*, and civil engineer of note, who made a personal investigation of the St. Francis dam and site the day following the disaster. Engineers of the Los Angeles Bureau of Waterworks and Supply and of the Southern California Edison Company and of other municipalities and utilities have been consulted in an effort to present here the most accurate statement of facts and conclusions possible to date, March 22.

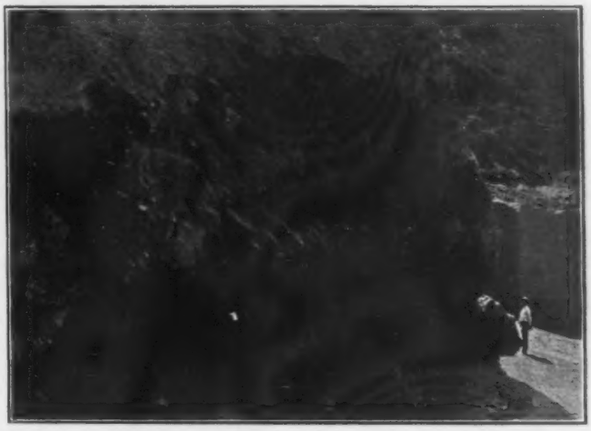


Fig. 6. Close-up under the right face of the erect section showing the character of the foundation material and showing the pour line clearly defined. The depth of this eroded channel in the dam foundation may be determined by comparing the size of the man shown.

According to the Los Angeles Bureau of Power and Light, the equipment and property at the San Francisquito No. 2 plant was valued at $1,400,000. E. F. Scattergood, chief electrical engineer of the Bureau, in a report submitted to the Board of Water and Power Commissiners Monday, March 20, stated that machinery and equipment to the value of $400,000 is salvageable. He further stated that an expenditure of $1,000,000 would be required to rebuild the No. 2 plant as it was before the flood. Authorization was given to Mr. Scattergood by the Board to proceed at once with the reconstruction of this plant. According to the same authority it is reported (March 22) that the acqueduct breaks will be repaired and the line ready for service by Monday, March 26. This will enable the No. 1 plant to resume operation provided its 110-kv. transmission lines have been repaired by that time.

All of the equipment in the plant was torn loose and swept away with the exception of the waterwheels and generators. The concrete foundations in which these units were anchored also remain. Oil circuit breakers, transformers and other heavy equipment were carried hundreds of yards down the canyon and, when partially located, were embedded in deep layers of silt and debris.

St. Francis dam was designed and built by the Los Angeles Bureau of Water Works and Supply of which William Mulholland is chief engineer and general manager.

Spreading the Farm Electrification Idea

Exhibits of Household Appliances and Farm Equipment at Agricultural Shows Pay Own Costs and Open New Business Channels

By L. W. Brainard

Acting Sales Manager, Idaho Power Company, Boise

ONE OF the problems confronting committees on the relation of electricity to agriculture and power companies alike is how to get the findings of the committees into the hands of farmers that might be benefited from a knowledge of these findings. In an attempt partially to solve this problem and in the general interests of rural electrification, the Idaho Power Company determined to conduct more elaborate displays at the county fairs in its territory in the fall of 1927. As part of this plan the company invited the Idaho Committee on the Relation of Electricity to Agriculture to occupy a part of its display space so that the results of the investigational and demonstration work being conducted at the Caldwell substation farm by the state committee could be brought to the attention of the farmer visitors. In this manner a number of pieces of electrically operated equipment were shown and a general message of rural electrification was delivered to many thousands of farmers at twelve fairs in southern Idaho and northeastern Oregon.

Publicity Material and Displays

To bring the work of the state C.R.E.A. forcibly to the attention of the farmers, the committee published a progress report, dated August, 1927, an attractive, illustrated booklet, which was handed out to those visiting the display. In addition, the current issue of the magazine, "Electricity on the Farm," likewise was given out along with miscellaneous pamphlets describing equipment. Realizing that much of this would not be read at the fair and might be thrown away before the recipient left the grounds, all this literature was placed in a large paper shopping bag on which was printed a message pertaining to farm electrification. The idea was that these bags containing the publicity material would be carried home, where much of the literature would be read at leisure.

Suitable space in the regular display building was sought in advance of the fair dates, but where this space was not available, arrangements were made to put up a 30 x 50-ft. tent to house the display. Since it was impossible to move the equipment used at the Caldwell experimental farm to the various fair grounds, negotiations were made with local merchants and dealers for the loan of similar equipment. Thus the displays varied at the different fairs according to the co-operation received from the merchants and to the farm equipment available in their stocks. Excellent assistance was received from jobbers and manufacturers' representatives in completing the display and in furnishing attendants to explain and demonstrate the equipment.

Supplementing the equipment displayed, large mat boards were prepared to carry enlarged photographs, full-page advertisements on rural electrification by the General Electric Company and N. E. L. A. clipped from national publications, and similar publicity material. Advertising banners and cards were likewise used to advantage.

Experience showed that a display in an individual tent secured the best attention from visitors, since there was no nearby exhibit to distract the attention. Equipment in motion was effective in securing interest, but it was found that the device in motion should be placed far enough back from the entrance so that the curious would have to come inside the display to see it well, otherwise the visitors might pass by without entering after stopping to note the movement that attracted their eyes. Within the display space aisles of traffiic should be so arranged as to make it necessary for visitors to pass through the entire exhibit and out another doorway. Brief and large-type display advertising was the most effective because it was the more generally read.

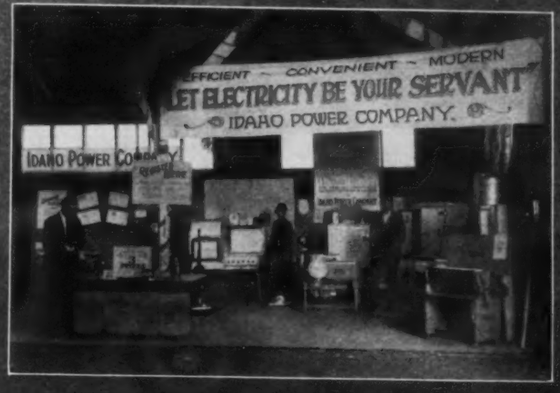
Registration and Results

A major feature of the company's exhibits was the registration of visitors. To induce this the company gave away on the last day of each fair three prizes of electrical appliances to winners drawn from the registration cards. Two cards were provided, one for customers and one for non-customers. On the former were listed a number of the more common household appliances and electrically driven farm equipment, so that the customer could record the use he was making of electricity and check other uses in which he might be interested. On the non-customer's registration card questions were asked pertaining to the visitor's proximity to the company's rural distribution lines, so that it could be determined whether or not he was a prospect for a rural extension. By this means some very valuable information was gathered from which the company will be able to continue its promotion of farm electrification.

A summary of the registration at the twelve fairs showed that of a total of 6,334 registered visitors to the company's exhibits, 5,103 were customers and 1,231 were non-customers. Of the non-customers, 387, or 31½ per cent, were considered to be possible new extension prospects. The ultimate success of this activity remains to be proved by results to be secured in the local territories where the fairs were held, and to facilitate the proper follow-up of possible extensions and merchandise sales the registration cards have been turned over to the local district offices. From the extension applications received and the merchandise sold at the fairs, coupled with the indication of considerable good will created, it may be said that the activity as a whole was worth its cost and effort.

Farmers Get Message of Rural Use of Electricity

THE benefits of electricity on the farm were brought to the attention of farmers throughout Idaho and northeastern Oregon last year through displays at twelve regional fairs. The Idaho Power Company and the Committee on the Relation of Electricity to Agriculture with the cooperation of dealers, jobbers and manufacturers conducted a series of exhibits some of which are pictured on this page. Merchandise sold and prospects secured more than offset display cost.



Glines Plant Under Supervisory Control

13,333-kva. Hydro-electric Unit Controlled From Plant Seven and One-half Miles Away

GLINES CANYON hydro-electric plant of the Northwestern Power & Light Company has the distinction of containing the largest single water-wheel generator unit to be controlled by semi-automatic remote supervisory equipment. This new plant is situated on the Elwha River about 7½ miles upstream from the Elwha plant of the same company and is about 15 miles southwest of the City of Port Angeles, Wash. Preliminary investigations on this site were begun in 1921; construction was begun in April of 1926 and completed April 29, 1927.

By means of selector-type supervisory control equipment operating over a 3-wire circuit from the Elwha plant the Glines machine may be started and stopped, the speed varied, the voltage of the generator raised or lowered and the load varied at the will of the operator in the Elwha plant.

Water supply for the plant comes from the Elwha River and its 244 sq. miles of drainage area above the Glines dam, a mean annual run-off of approximately 1,000,000 acre-ft. About 300 sec.-ft. is the average unregulated minimum flow of the stream. The storage reservoir itself has a capacity of about 43,000 acre-ft. and with a maximum draw-down of 57 ft. and a mean operating head of 188 ft., provides 20,000 acre ft. for power purposes.

The reinforced concrete dam is of the varied-radius single-arch type, 210 ft. high to the spill-crest and surmounted by a walk-way 10 ft. above the crest. The base of the dam is only about 55 ft. long due to the narrowness of the river gorge at that point. Approaching the crest, this gorge widens out materially on the east bank of the river, necessitating the anchoring of the upper section of the main portion of the dam in a very heavy abutment block. From that abutment block on up the slope to the necessary elevation an auxiliary wing dam has been built.

Crest length of the dam proper between the gravity abutment block on the east end and the spillway on the west end is 152 ft. The spillway section is 121 ft. long and provides for five 18 x 20-ft. Tainter gates. The sluiceway is located at El. 470, 60 ft. above the base of the dam, and is controlled by a butterfly type gate.

The center line of the pressure tunnel inlet is at El. 527, 83 ft. below the crest of the dam. The inlet is provided with a trash rack and raking equipment, the rack itself being 20 x 40 ft. in dimension.

The power tunnel itself is 569 ft. long and operates under a head varying from 80 to 108 ft. It is driven through solid rock and in cross section is 14 ft. wide and 13 ft. high to the spring line of the arch, which has a rise of 4 ft. At a point 190 ft. downstream from the intake there is a shaft through which is operated a caterpillar-type control gate. This serves as the intake control gate.

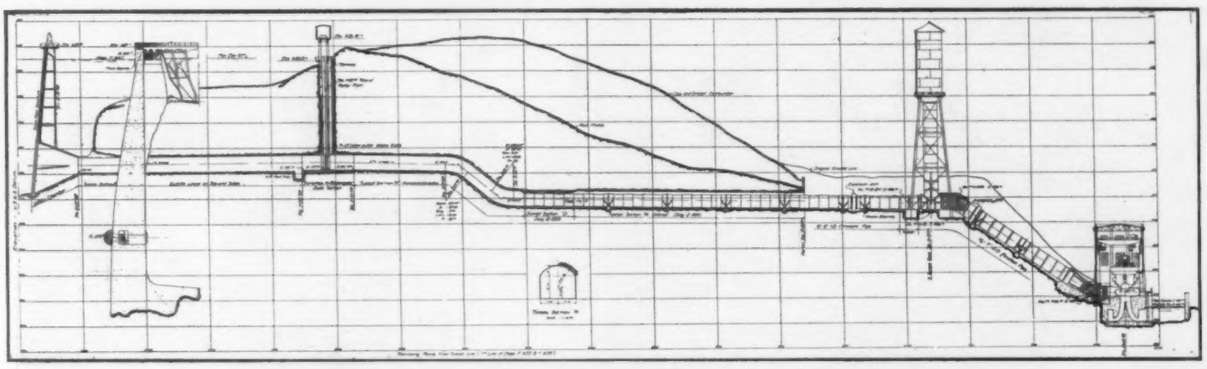
From a point about 157 ft. downstream from the control gate the tunnel is plugged directly to a steel pressure pipe, 10 ft. in diameter and 321 ft. long. As indicated in the accompanying profile, the tunnel was plugged into the penstock pipe line at this point because beyond this point the overburden was not considered sufficient for safety. A surge tank of the Johnson differential type is connected with the penstock through an 11-ft.-riser pipe. The surge tank is 20 ft. in diameter and 50 ft. high with an interior riser of 9-ft. diameter.

The penstock from the surge tank to the turbine is steel pipe, 11.5 ft. in diameter and 158.7 ft. long, with a taper connection to an 8.5-ft. butterfly valve at the inlet to the turbine casing. The total length of the pressure tunnel and penstock line is 857 ft.

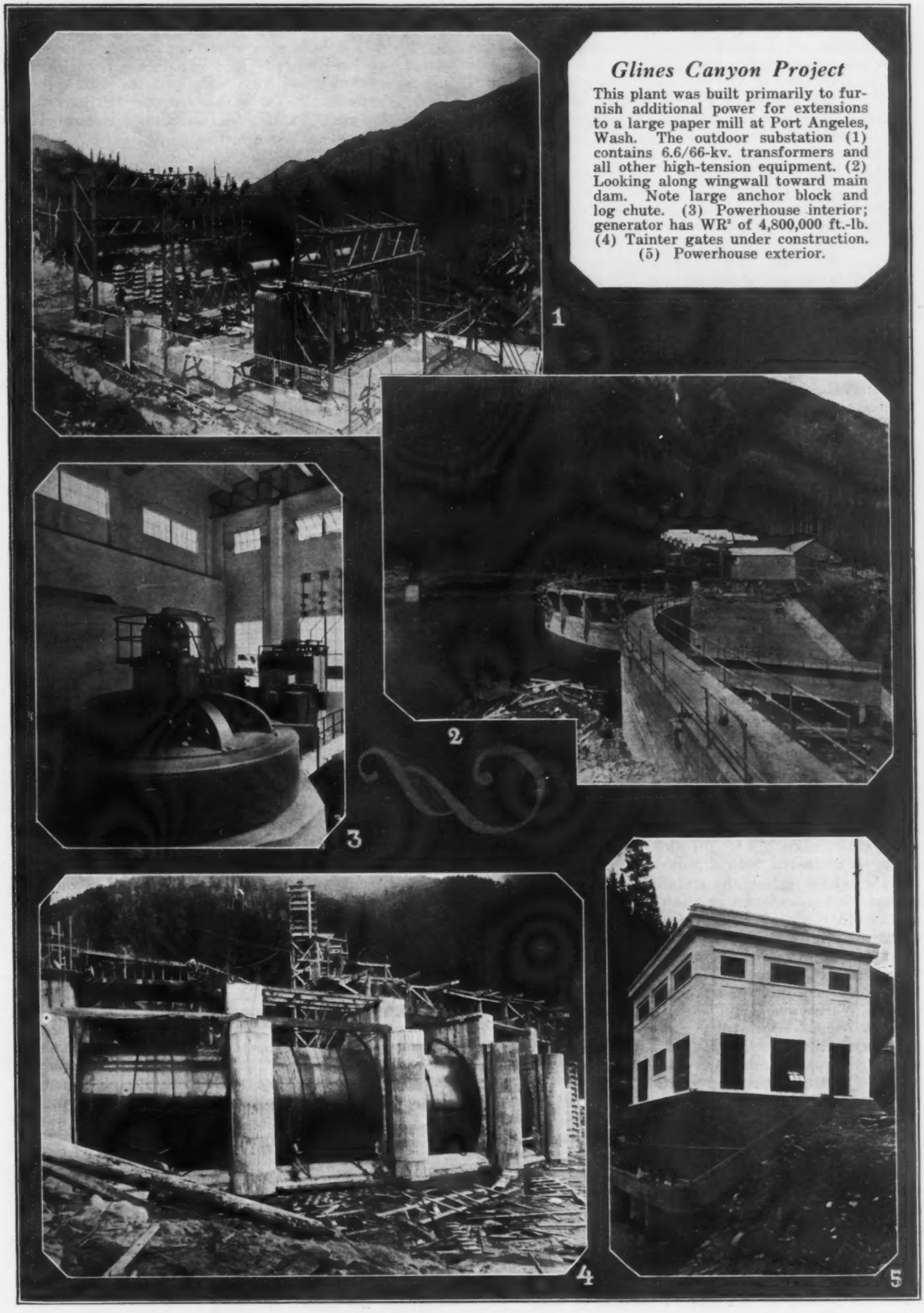
For convenience in interpreting the accompanying profile, the following tabulation of elevations is given:

Elevations Above Sea Level

Rock elevation at bottom of draft tube	397
Center line of runner	423
Main floor power house	430
Switchboard gallery floor and generator base	438.8
Crane rail	461
Top of roof of power house	477.5
Top of surge tank	631
Center line of penstock at base of surge tank	496
Bottom of surge tank	581
Center line of inlet of pressure tunnel	527
Base of dam	410
Crest of dam	610
Stream bed	430
Top of walkway on dam	620
Five-ft. sluice gate outlets	470



Section along center line of Glines flow line with dam superimposed.



Glines Canyon Project

This plant was built primarily to furnish additional power for extensions to a large paper mill at Port Angeles, Wash. The outdoor substation (1) contains 6.6/66-kv. transformers and all other high-tension equipment. (2) Looking along wingwall toward main dam. Note large anchor block and log chute. (3) Powerhouse interior; generator has WR^2 of 4,800,000 ft.-lb. (4) Tainter gates under construction. (5) Powerhouse exterior.

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The 40 x 60-ft. power house building itself is of reinforced concrete and is located about 800 ft. downstream from the dam. The building contains all of the electrical equipment except the substation equipment and is designed for only the one main generating unit together with the necessary control and auxiliary equipment. The main water-wheel generator is rated 13,333 kva., 6.6 kv., 3 phase, 60 cycle, 225 r.p.m. An auxiliary water-wheel drives a 62.5-kva., 220-volt combination motor and generator (in one machine). The auxiliary unit is designed to operate as a generator when the main unit is shut down in order to furnish station light and power and to operate the oil pump for maintaining oil pressure on the governor.

When the main unit is in operation the auxiliary machine is connected automatically to the high-voltage station bus and is driven as a motor for operating the oil pump only. The slightly higher operating speed thus resulting causes the automatic shutdown of its waterwheel the same as for any other overspeed condition.

Water-wheel equipment consists of a Pelton-Francis vertical-shaft turbine rated 19,500 hp. at 180-ft. head with full gate, and an 80-hp. wheel for the auxiliary set which furnishes power and light for the station when the main unit is shut down.

Air for generator cooling is drawn from the turbine pit and is discharged into the atmosphere outside of the power house building through ducts. All auxiliary apparatus is at the south end of the main floor and somewhat under the switchboard balcony. Also under the balcony is a room in which are the oil storage tanks and oil treating equipment, and another room housing the storage battery charging set and other equipment.

On the gallery, as shown in one of the accompanying illustrations, are all of the controls, high-tension, low-tension, and supervisory. These control panels are mounted parallel to the east wall while along the south wall are the 6.6-kv. disconnects and oil circuit breakers for the main generator and the station service transformers. From this structure the 6.6-kv. leads leave the building and are taken up the hill to the outdoor substation.

As a result of the close system speed regulation required on the power system in order to serve satisfactorily its paper-mill load, the Glines generator is of special design. WR^2 for this machine is 4,800,000 ft.-lb. as compared with a normal of 2,500,000 ft.-lb.

As a safety feature the main butterfly valve must be opened by hand control at the Glines plant before any of the other equipment will function. The opening is accomplished by hydraulic pressure but, once opened, the butterfly valve is held in that position by a solenoid which is subject to subsequent control by the automatic and protective features of the operating equipment. When, and only when, the butterfly valve is entirely opened a control circuit is completed through auxiliary contacts which permit subsequent operation of the governor to control the wheel gate mechanism on the unit itself. Operation of the butterfly valve also releases the generator brakes and then they are held in an open position by another solenoid.

Before the starting indication can be given the station feeder breaker must be closed and the auxiliary generator and tie breakers must be open. Indication for starting the auxiliary unit is given locally by closing the control power switch. The master contactor then closes and energizes the operating mechanism on the governor which controls the wheel gate. Exciter voltage builds up as machine speed increases and finally the alternator field is energized and the circuit breaker closed to connect the machine to the station bus.

The starting indication for the main unit may be given locally by closing the "start" switch or at the remote station by means of the supervisory system. In either case the butterfly valve must be opened by hand first, as before mentioned. Machine starting sequence then progresses the same as for the auxiliary unit. While the main water wheel is being accelerated the field of the self-excited direct connected exciter is building up rapidly. The 250-volt d.c. control bus is permanently connected to the exciter armature and therefore is energized directly by it. The exciter voltage is regulated by a feeder voltage regulator, the value of voltage depending upon the load on the main generator.

Synchronizing, of course, either may be done at Glines plant or at the Elwha station. If synchronizing is done at the Elwha station full control of the Glines unit is effected through the selector type supervisory equipment, which makes it possible for the Elwha operator to raise or lower the speed of the machine, to raise or lower the field voltage and otherwise to effect complete control of the unit to bring it into synchronism with the rest of the system. A motor-driven equipment under the control of the supervisory apparatus operates through the governor to vary the machine's speed and another operates on the main field rheostat in order to control the generator voltage as may be necessary.

If the machine is to be synchronized at Glines station, the transmission line from Elwha of course is energized from the Elwha station and the Glines Canyon plant may be synchronized at the Glines switchboard with the usual type of manually controlled synchronizing equipment.

Once the Glines generator is on the line its load may be controlled from the Elwha station by means of a motor driven machanism similar to those used for speed and voltage control. To shut down it is necessary only to remove the load from the main generator, either by supervisory or manual control; subsequent operations are automatic.

The substation is located up on the side of the hill back of the generating station, as shown in one of the accompanying illustrations. The equipment consists of three 4,500-kva., 6.6/66-kv. air-cooled transformers together with the necessary oil circuit breaker and lightning arrester equipment. Transmission between Glines and Elwha plants is at 66 kv.

Glines plant was designed and built by Thebo, Starr & Anderton, Inc., of San Francisco, under the direction of F. M, Thebo,—W. B. McMillan, chief engineer, W. A. Whitmire, superintendent, H. R. Stevens, electrical engineer, and H. Schorer, hydraulic engineer. ELECTRICAL WEST is indebted to W. B. McMillan, and to W. L. Thrailkill and R. H. Crosby of the University of Washington, for the information from which this article was prepared. All of the major electrical equipment including the selector-type supervisory installation, metering and control equipment and the outdoor transformer station was supplied by the General Electric Company.

As the first step toward the development of the two other logical power sites on the Elwha River, the Northwestern Power & Light Company already has made application for the development of its Rica Canyon site. This project is about four miles upstream from the Glines Canyon plant and contemplates the appropriation of 1,200 sec.-ft. from the Elwha River and the storage of 65,000 acre-ft. behind a 300-ft. arch-type dam. The Rica project is expected to develop 22,000 hp. and probably will cost about $2,200,000. The second future possibility is the Press Valley site near the headwaters of the Elwha River.

Large classroom used for drawing classes, employing the lighting standard of the equivalent of two rooms.

Setting Up Electrical Standards for Fresno Schools

Lighting and Electrical Installation Derived as Natural Result of Foresight Into the Needs and Demands of the Future

NOTHING can become quite so dejected looking in the light of today's modern school buildings as a school built some twenty years ago. To the old graduate, whose memory is filled with roseate dreams of the school house of his boyhood, a visit to the old alma mater serves as a severe shock. The school building of the past seems to be the only thing which has not been brought up to date.

Will the school building erected today find itself, in twenty years, as hopelessly antiquated as those of the past two decades? Beautiful buildings they are now, but will the mechanical and electrical facilities now in the walls prove adequate to meet the requirements of other advancing generations?

To questions such as these more than casual thought was given in Fresno, Calif., after the voters of the city had authorized $1,800,000 in bonds with which to finance the building of ten new schools, five new gymnasiums, four new wings to present schools and several alterations.

William John Cooper, then superintendent of the city schools of Fresno—since elevated to superintendent of public instruction for the State of California—desired to utilize the public funds so created not only to meet present pressing needs for more school facilities but also in such a way as to make these works endure. They must be made as nearly adequate for future needs as present foresight could make them.

The first step in this direction came with the formation of a "Committee on Standards" with H. H. Courtright, manager, Valley Electrical Supply Company of Fresno, as member representing the electrical branches of construction, which committee's work was to establish standards governing construction of each of these schools, scrutinizing their plans and specifications and testing out materials entering into their construction.

These standards were drawn for every phase of building construction, such as masonry, carpentry, plumbing and wiring. The electrical standards were entrusted to Carl F. Wolf, consulting electrical and illuminating engineer for the Valley Electrical Supply Company.

Wiring standards, under any less imaginative and creative person than Mr. Wolf, might have gone the ordinary course from switchboard to pipe to panels to lamps. The viewpoint of the electrical engineer toward the electrical installation is often that of a technician dealing with forces and apparatus which nobody else cares anything about and he proceeds from the engineer's viewpoint rather than from that of the user.

To start backward, as Mr. Wolf did, is so unique a principle, both in the complete way in which it convinces the user and in the results it gets in greatly improved electrical installation in the long run, that no story of the Fresno standards of school lighting could be complete without the very reason for their existence. The first consideration, according to this plan of approach, is the provision of adequate lighting, from whatever source, so as to safeguard the eyes of those using the school building. The means to provide that illumination follow as a natural consequence of the establishment of lighting standards. It was not a case of wiring first, but rather of illumination first, and wiring afterwards in order to provide the means. The following statement from "A Standard of Lighting for School Buildings" sets forth that principle:

In contradistinction to LIGHTING, good or bad, I define ILLUMINATION, good or bad, as a scheme of lighting which not only takes into consideration the intensity of the source, and its kind, but also such factors as location of source, variableness of intensity, color, shading and adaption to surrounding design and color motives, making possible the partial or full expression of the emotional value of LIGHT.

Or, in other words, LIGHT may be spoken of as the cause, and ILLUMINATION as the effect.

In devising a standard of illumination for school buildings we are primarily concerned in the matter of creating artificial illumination which will supplement daylight illumination at the early and late hours of the day, and at such periods as when the sky is overcast.

It is important that provision for adequate artificial illumination be made whether the schools are used at night or not. To plan for this artificial illumination it thus becomes a matter of studying:

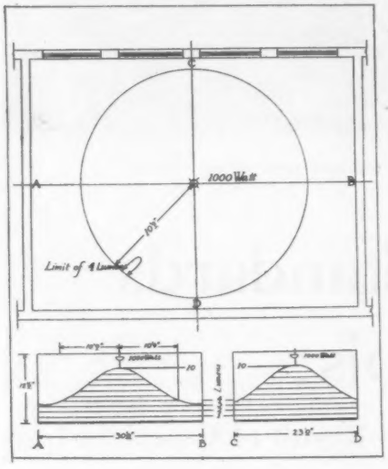
First: The illumination desired and demanded.

Second: The electrical engineering necessary to wire for such illumination.

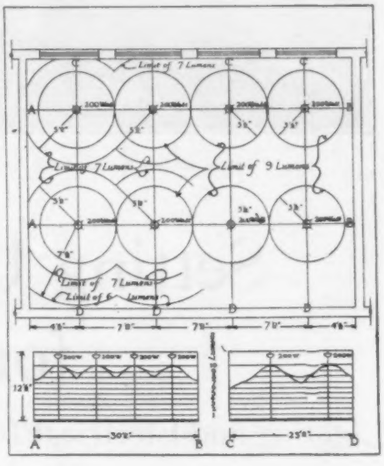
Third: The proper choice of luminaires or lighting units and specifications covering same.

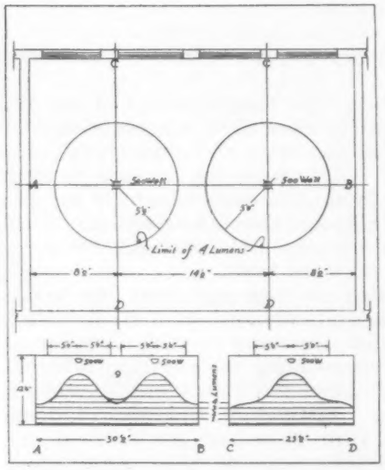
A Study of Illumination Desired: After the individual needs of the various rooms, etc., of a school in respect to illumination have been studied, a specification or a standard may be designed which shall cover the various factors entering into proper illumination, such as the intensity necessary to furnish the proper amount of light, the location of the source or sources of light within the room or rooms, the type of luminaire, the color values of the light, the sizes of the lamps and the shading and adaption to surrounding design, and the color motives of the respective rooms to be illuminated.

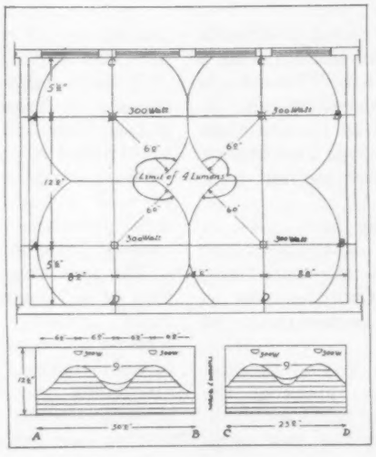
Electrical Engineering: The electrical engineering practice and the specifications covering same actually become a matter of individual study and preparation of suitable plans and specifications for each school, so we have attempted to set down a few general facts and recommendations in the following paragraphs.

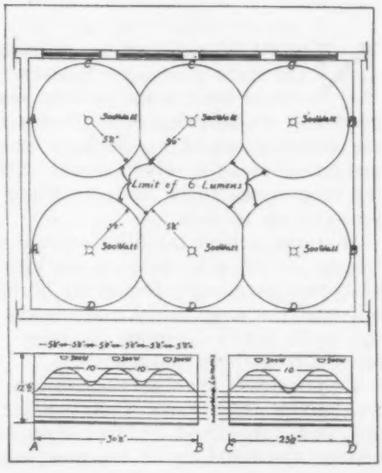


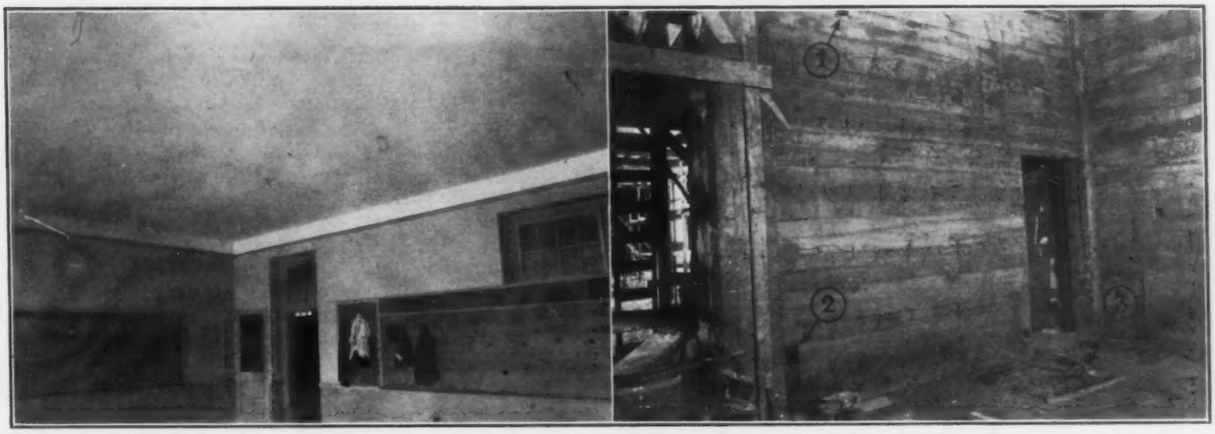
Taking a typical classroom light distribution was demonstrated by means of the charts shown here. The top of each chart shows the plan view, with the placing of the unit and the limit of 4 lumen distribution. The lower portion of each chart shows the cross section of both width and length of the room. The light distribution is shown by the mound beneath each unit. By this means it was demonstrated that the best "depth" of illumination, the evenest distribution, would be obtained by the use of eight units whose combined wattage would be no greater than the one unit in the first chart. The effect of placing the rows of units near the windows to simulate daylight conditions, is also demonstrated in the chart at the right.











Left: Typical classroom before completion. The four ceiling outlets on one side may be noted, as well as the outlet for heater below the blackboard space. Right: Location of stage switchboard, at roughed-in period. (1) An arc pocket to operate spot from top of switchboard. (2) Pocket for stage spot. (3) Terminals of conduits for switchboard feeders and circuits.

It is further recommended that the architects be instructed to engage the services of an electrical and illuminating engineer to prepare suitable plans and specifications in harmony with the standards outlined herein.

Standard of Illumination: The illumination required for school buildings is attained:

First, by the use of natural light when in use during daylight hours. Disposition and size of windows to attain the standard of illumination outlined in the latter paragraph is a matter to be carried out through the respective branches of construction involved.

Second, when school is in use during periods when natural light fails or is absent. The various rooms which may be occupied by teachers or pupils shall be provided with artificial light sources to give an illumination in accordance with the rules laid down by the Code of Lighting for School Buildings as prepared by the Illuminating Engineering Society and the American Institute of Architects and approved as the American Standard, June 16, 1924, and attached hereto as reference.

The text then quotes the code of lighting before detailing anything of the wiring requirements, taking up in logical sequence the subjects of: illumination required, minimum values of illumination required and values recommended for artificial lighting, avoidance of glare, distribution of artificial light, color and finish of interior, exit and emergency lighting, luminous flux emitted from lamps, etc.

Demonstrating the Principle

As a concrete example of application of the principles enumerated in the lighting code, Mr. Wolf then appended an ingenious demonstration, by means of drawings, illustrating light distribution in a typical room by means of one central unit of 1,000-watt capacity as against the distribution of light possible with the same lumen capacity divided up among two, four, six and finally eight units, correctly spaced and mounted. The accompanying illustrations show the drawings used to demonstrate the principle.

"In explaining these charts to the committee," says Mr. Wolf, "I likened light to sand. For an infinitesimal fraction of a second, let us say, globules of light are emitted from the unit even as sand globules might be poured from a hole into the room from that point. The resulting distribution of the globules from one unit in the center of the room would be very much like that in the first drawing. A "depth" of 4 lumens, the recommended *minimum* of the lighting code, would be limited to a circle of 10-ft. radius and the little boy or girl in the corner of the room would have insufficient light, whereas those children in the center of the room would have much more than their share."

The even distribution of globules in the last drawing, that with eight units of 200 watts each, convinced the committee and was instrumental in the establishment of a standard for Fresno schools based upon eight units per room of typical size.

Another interesting feature of the standard established is that the parallel rows of units are placed relatively close to the windows so that as nearly as possible artificial lighting will come from the same direction (over the left shoulder) as the natural daylight from which the seating arrangement of the classrooms is determined.

Space will not permit more than brief mention of some of the more interesting and unusual developments of standards based upon the sound premise of good illumination, established first as the reason for the existence of all recommendations which followed.

"There was not a single recommendation made, not a single plug or outlet spotted which did not have a good and defendable reason back of it which made it imperative that it should be there," said Mr. Wolf. Some of the details follow.

From the Illuminating Standard

The eight-unit plan for a 23 x 30 x 12½-ft. room is designed to deliver an intensity of 10 lumens per sq.ft., or a wattage of 2.2 per sq.ft. This is equivalent to approximately 10 lumens per sq.ft. on a working plane 2 ft. above the floor line, providing the ceiling has a reflecting coefficient of 70 per cent and the walls of 50 per cent and provided a highly efficient enclosed glass luminaire or lighting unit is selected and installed. The arrangement will give, it is stated:

(a) The most **uniform** and generally efficient intensity at the working plane by avoiding excessive variation in illumination upon the working plane.

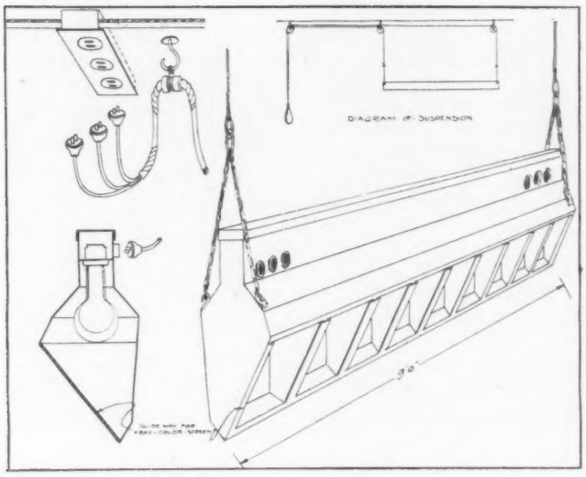
(b) It will give the major portion of light over the left shoulder corresponding to the scheme of **natural** illumination by windows placed at the left-hand side of the pupil. The eyes of pupil and teacher, therefore, are not called upon to make a readjustment by the transition from daylight to artificial light.

(c) It will overcome **glare** generally found with the use of a single or a few high intensity efficient units installed at the ceiling height of the classroom chosen, by directing the total intensity demanded from several sources of light of lower intensity using the same type of luminaire.

(d) The above arrangement will do away with excessively dark **shadows** usually the direct result of the use of high intensity units by the distribution of the total intensity demanded through several sources of light of lower intensity.

(e) It will overcome **reflective glare** at the working plane for the same reason as outlined under (c) and (d).

(f) It will provide for uniform illumination of the blackboards and overcome dangerous reflection from them.



Details of border light trough with detachable plug feature to make for portability.

Another interesting and far-sighted recommendation is that if there is any likelihood of conversion of office rooms into class or study rooms at some later time the grouping and placing of outlets should be in harmony with the recommendations for classrooms.

For Stage and Auditorium

Besides the recommended wattage for auditorium lighting the standard also recommends aisle lighting, convenience outlets for stereopticons or vacuum sweepers, exit lights, etc. For the stage footlights (see illustration) the recommendation is that they be no less than 66 per cent of the precenium opening, allowing space for the movement of pupils from the auditorium to the stage, and be equipped for large wattage lamps with color screens locked in place, and with plugs for small footlight spots on seperate control. The use of straight footlights in connection with a straight forestage is recommended as a means of saving in construction.

Border lighting is provided for by means of detachable borders, as will be described later. Outlets for work lights, wall plugs and floor stage pockets for the use of stage spots, orchestra pit lights and plugs for music racks, and complete switchboard equipment, are recommended.

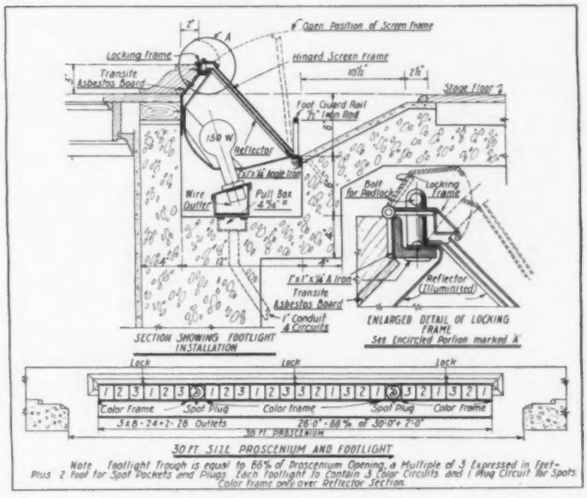
When it came to working out definite specifications for many of these details there were evolved many ingenious ideas for the provision of the utmost flexibility. With a well planned supply of electricity available portable apparatus could be exchanged from school to school until funds for permanent equipment were available for each individual school.

The stage switchboard, for example, is designed with the lower left-hand portion cut away to allow the sliding in of a portable dimmer bank, which can be plugged into the board for the control of stage lighting. It was not feasible financially to install complete switchboards and stage equipment without the sacrifice of some other feature of the school building. Mr. Wolf persuaded the committee that it was wisdom and economy to provide sufficient capacity for future needs in feeders and circuits which could take care of complete equipment, and to buy but one complete set of borders, arcs, etc., and one dimmer bank and arrange to move them to whichever school needed the equipment for a performance. One unit of border light troughs, then, is left at each of three high schools to be used in rehearsals. In the event of a performance the three borders are brought to the one school for the period of the performance. All stage electrical equipment may be locked.

Another idea of merit is to be found in the way light is supplied for the orchestra pit. For rehearsals, rather than have students use music stands and music stand lamps plugged into convenience outlets provided, leaving them to be kicked around and damaged, two separate lighting units are incorporated in the ceiling fixture above the pit, controlled by a double-throw switch on the switchboard, preset on remote control to be operated by a tumbler switch from the pit itself. These fixtures provide sufficient light for music rehearsals.

Wiring Specifications

Following the recommended lighting standards are listed the wiring standards proposed to supply the means by which to make possible the previous recommendations and also to give adequate electrical service to the


Open Position of Screen Frame
Locking Frame
Transite Asbestos Board
Hinged Screen Frame
Stage Floor
Foot Guard Rail
Reflector
Wire Outlet
Pull Box
Bolt for Padlock
Locking Frame
Reflector (Illuminated)
Transite Asbestos Board
1" Conduit 4 Circuits
SECTION SHOWING FOOTLIGHT INSTALLATION
ENLARGED DETAIL OF LOCKING FRAME
Lock
Color Frame
Spot Plug
3 x 8 - 24 = 2 - 26 Outlets
26'0" = 86% of 30'0" = 7'0"
30 FT. PROSCENIUM
30 FT. SIZE PROSCENIUM AND FOOTLIGHT
Note: Footlight Trough is equal to 86% of Proscenium Opening, a Multiple of 3 Expressed in Feet-
Plus 2 foot for Spot Pockets and Plugs. Each Footlight To Contain 3 Color Circuits and 1 Plug Circuit for Spots.
Color frame only over Reflector Section.

Details of locking footlight trough also showing distribution of outlets and provisions for spots.

building. These specifications begin with the service run underground from the power company pole to an ample switchboard room or transformer vault as in the case of all high school groups.

In all cases it is specified that switchboards, feeders, etc., shall be sufficient for immediate and for all contemplated future demands which may be made upon them. A vault for battery emergency lighting equipment is also provided.

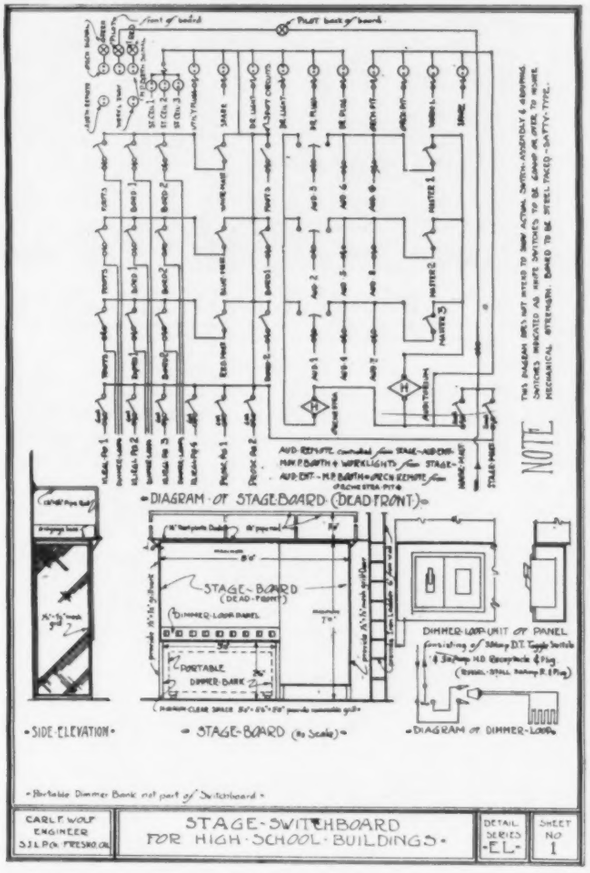
Convenience outlets are enumerated and in each case the use to which they may be put is described as complete justification for their inclusion. Circuits are limited to four receptacles per circuit. Heavy duty heating outlets are recommended in all offices, teachers' rest rooms, kindergarten rooms, parent-teachers' rooms, Boy Scout rooms, and at least one classroom of each school as supplementary equipment in order that the rooms may be used individually after regular school hours when the regular school heating plant is not in operation. Five-kilowatt-capacity plugs and portable equipment suitable for exchange between schools are recommended because they permit a more rapid building up to the required temperature..

Switches controlling hall lighting, to prevent tampering with them, are key switches and are mounted 6 ft. from the floor. Where two switches are used in classrooms they are so arranged as to make possible the use of one-half the classroom for small classes without illuminating the rear portion of the room.

For the lighting of special rooms the details are also well worked out. Dressing rooms in connection with the stage are specified to have a pair of bracket lights over a table for make-up at a mirror, these lamps to be protected by wire guards. Study rooms and libraries are to be wired to provide 10 lumens per sq.ft.; art and sewing rooms to have 10 to 15 lumens, or three watts per sq.ft.

Feeders from shops and gymnasium buildings, adjacent to the main building, are run in conduit to the retaining wall of the basement. The conduits, with spare conduits for future feeders, terminate in a pull-box set into the wall of the areaway down which steps to the basement are placed. Conduits from the main board also terminate here, facilitating the pulling of cable between buildings.

In these standards also an effort has been made to provide sufficient raceways for telephones, inter-phones,



Details of typical stage switchboard, with provision for inserting portable dimmer bank. Note deck on top of board to be used for spot control.

clocks, and even public address systems, as well as inter-school and city fire alarm systems.

These are but a few details described from a very complete and exhaustive outline of standards but they will serve to show with what thought the preparation of these details has been invested and how each electrical provision is but the unquestionable consequence of a desire to anticipate and meet every demand which teachers, pupils and public will make upon that school structure. From the teachers', the pupils', and the public's standpoint there is nothing else that can be provided which in the long run will be at all satisfactory or economical.

Some Further Consequences

From the electrical industry's standpoint the situation is very nearly ideal. The electrical installation which might have been limited to an expenditure per $50,000 elementary school of but $1,500 to $2,000, now runs closer to $3,500, and there is not a single apology to be made for a cent of the increase. Instead, from the public's standpoint, nothing less would be acceptable because it would mean an inadequate installation which would render a new school old years before it had reached its prime.

The power company is served with a bigger load and under more satisfactory conditions. It has ample transformer vault and service provision. The electrical contractors are well pleased because the specifications are definite and concise and there will be tolerated no cutting on the job, placing bidding upon a very high plane of competition.

From the manufacturers' and jobbers' standpoints there is a much better bill of materials. The standards set up include listing of approved materials and equipment. The fact that each of the typical classrooms now has three circuits to supply it where schools of former days were fortunate if no more than three classrooms were supplied from one circuit, sums up in a few words the advantage accruing to the electrical industry.

There are three junior high schools affected by these standards on the building program—one completed, one under construction and another in preparation. There are four gymnasium buildings coming under this program and these standards—three completed and the fourth just started. There are seven elementary schools —three near completion, one completed, and three started, besides three or four additons to present schools, all finished, each of which has been built under these standards.

But the influence of the standards is not limited to Fresno. Schools in other parts of the country are being built to the same plans and specifications. Sanger High School is the first and many other schools in the San Joaquin Valley either have under way or contemplate remodeling which will bring to them the illumination demonstrated so well by the Fresno models.

The Edison Junior High School in which most of the photographs accompanying this article were taken, although located in the poorest section of Fresno, is so well illuminated that it is carrying the bulk of the night school work of the city. The principal of the school, W. L. Potts, is enthusiastic over the plan and watched its development with a great deal of interest.

Walter R. Hepner, superintendent of city schools of Fresno, who took up the work of carrying the idea through after Mr. Cooper had barely started it, is also very well pleased with the results which the adequate standards of illumination and electrical installation have made possible.

Before Posterity's Cold Analysis

"You expect these buildings to be used for the next fifty years, of course?" Mr. Wolf asked the school board when someone demurred at the proportion of building cost which was being devoted to "wiring."

"Oh, more than that; a hundred years!" was the reply.

"Then you certainly do not want your names on the cornerstone of a building which ten years from now, in the march of modern electrical development, will be as antiquated as the ark!"

They did not, and as the evidence indicates, there will be very little that the school board of Fresno will ever have to be ashamed of electrically in these public works.

Combined Light and Suction-Fan Trap for Insects

RESULTS of experiments conducted at Clear Lake, Calif., indicate possibilities for controlling night-flying insect pests with a trap employing both an electric light and a small ventilating fan.

By W. B. Herms[1] and R. W. Burgess[2]

FOR MANY years the inhabitants of the shores of Clear Lake, Calif., have suffered throughout the summer months from a pest of non-biting, night-flying gnats. Great swarms of these gnats begin drifting in from the lake shortly before dusk on quiet evenings and increase as darkness falls so that one's existence near campfires and exposed lights at night is practically impossible. Open lights are literally choked and smothered by these insects.

The gnat in question is much smaller in size than a mosquito, which it closely resembles except that fortunately the gnat does not possess blood-sucking mouth parts. This particular gnat appears to be restricted to this one locality in California where nature has been most lavish in bestowing scenic beauty.

Fig. 1—Resort where the traps were used.

Both the zoological relationships of the gnat and the fact that it swarmed inland from the lake made it clear that it was of aquatic origin although prior to last summer (1927) its life history remained a mystery and, furthermore, prior to 1926 it was a scientifically unnamed species. At that time it received the name *chaoborus lacustris* by Prof. S. B. Freeborn of the University of California. Observations were first made by the senior author as early as the summer of 1916 when it became apparent that a prolonged field study would be necessary to solve the mystery of the insect's breeding habits, but it was not until 1927 that through the wise provisions of the Lake County Farm Bureau a small sum of money was made available to carry on an extended investigation. The junior author was forthwith appointed to investigate the mysterious breeding habits of the species and if possible to devise means for its control. Suffice it to say that the complete life history was worked out, the mystery being principally in the fact that the larvae are practically transparent organisms (phantom larvae) and develop rather far out from shore where the water is fairly deep, thus rendering control in this stage practically impossible.

Fig. 2—The trap complete as suspended from a cable. The lower part, or sack, catches the insects as they are drawn downward by a fan near the top of the tube. The vane is above the man's head, while the windshield is behind the reflector.

As already mentioned, the winged gnats (adults) are strongly attracted to light (positively phototropic) and hang like drifting snow about all lights. This fact led to the investigation of light traps as a means of control. This method of control made a strong appeal to both writers because these insects come ashore to mate and might be trapped before the females returned to the lake to lay their eggs. All ordinary light traps proved futile due to the fact that they soon became hopelessly clogged with gnats.

To obviate this clogging of the trap it was decided to add a sucking device in addition to the attracting electric lamp; a properly arranged electric fan seemed to be the thing to use. The original trap constructed to demonstrate the feasibility of this method of control consisted of the following parts:

1. A reflector made of common roofing tin, 18 in. in diameter, funnel-shaped to a depth of about 6 in. Inside the apex of the reflector was attached a light socket, the socket itself being inside the reflector and the plug end protruding above.
2. A sleeve (also made of roofing tin) about a foot in

[1] Professor of Parasitology, University of California; president, American Society of Economic Entomologists.

[2] Research assistant in Entomology, University of California.

diameter, suspended from the reflector at a distance of about 10 in. by means of three ¼-in. rods soldered lengthwise to the sides of the sleeve at regular intervals. The rods were made to extend above the reflector, the ends being used to suspend the whole affair.

3. A windshield made of strips of cello-glass arranged shutter-like on a wooden frame lengthwise of the trap. (See Fig. 3.) The windshield is necessary because the slightest breeze will push the cloud of gnats away from the trap and the influence of suction. Opposite the windshield and attached to the same wooden frame was placed a wind vane, also of cello-glass.

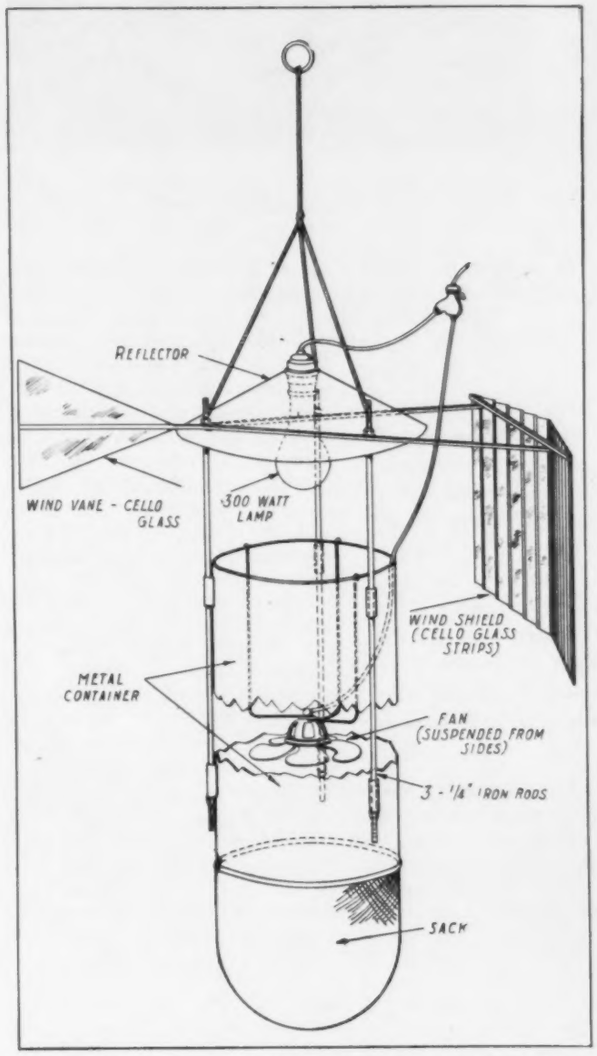


Fig. 3—Sketch of trap, showing arrangement of reflector, light, windsheld and fan.

4. A small fan with motor (used for ventilating purposes) was fastened to the sleeve by means of three arms on the motor. When in position the motor was above the fan which was about 4 in. from the bottom of the sleeve. There was from one to one and a half inches of clearance between the fan and the sleeve. Even with this clearance the gnats, when unusually numerous on warm, still evenings, would in time form a compact ring where the blades of the fan forced them against the sleeve and thus stop the motor. To protect the motor a fine bronze mesh was placed around it.

5. A 300-watt lamp placed in the socket of the reflector was used to attract the gnats.

6. A bag made of black muslin about 3 ft. deep was drawn over the lower end of the sleeve and firmly fastened with a cord so as to be removable to empty.

When in use the trap (Figs. 2 and 3) was suspended from a pulley attached to an arm on a pole planted at

Fig. 4—A section of the lake shore infested by gnats.

the water's edge. By means of the pulley ropes the trap could be raised or lowered according to conditions. It was found to work best when the light was from 8 to 9 ft. from the ground. The light was turned on about dusk when the gnats began flying. When in full operation the gnats about the light remind one of a snowstorm, with a steady flow by suction into the bag.

Some idea of the number of insects captured in this manner may be obtained through the fact that on two different occasions 11 lb. of gnats (Fig. 5) were trapped in two hours. During the summer a total of 156 lb. of gnats was captured. Since there are approximately between one and a half and two million gnats to a pound, one may readily conclude that some impression should have been made on the total gnat population. What

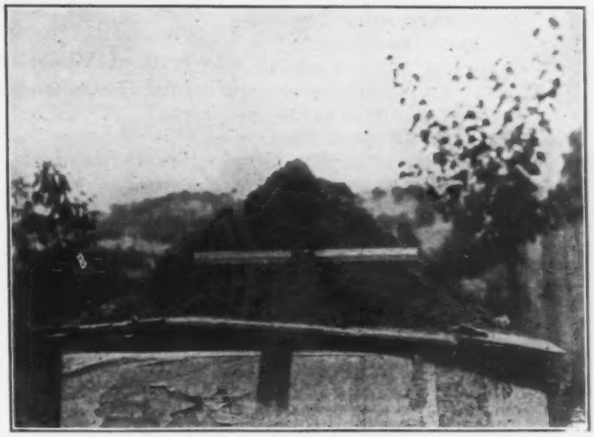


Fig. 5—A pile of gnats representing a two-hour catch, weighing 11 lb. The gnats number between one and a half and two million to the pound. A 12-in. ruler is shown for purposes of comparison.

the effect on next year's population will be remains to be seen; certain it is that literally millions of female gnats were captured before their eggs were deposited.

The immediate results of the experimental trap were most gratifying in that the resort thus protected (Fig. 1) showed a very marked decrease of gnats while those on either side were as greatly annoyed as ever. In order to give similar protection to the seventy-five or more miles of lake shore thus afflicted no doubt hundreds of traps would be needed, but the good results of last summer's experience prove that the effort would be well worth while.

Plowing With Electricity in Italy

Fig. 1. Electric plowing outfit showing four-gang reversible balanced plow. The portable transformer unit that completes the outfit is not shown in this picture.

"ELECTROCULTURE" is the term applied in Italy to extensive use of electrical energy in farming enterprises. Italy ranks high among the nations of the world in the use of electricity on its farms and now is engaged in a comprehensive plan for the furtherance of "electroculture." One of the most interesting farm applications in Italy and one that is gaining rapidly in acceptance is electric motor-driven equipment for plowing.

A full line of equipment has been developed, including portable power-line poles, portable transformer substations, electrically powered tractors, or "locomotives" as they are called in Italian literature, double-ended balanced gang plows, etc., to say nothing of the apparatus for harrowing, reaping, threshing and other allied tasks.

Mechanical equipment for the performance of many of these tasks has been in use for several years, as many as twenty-five years in some cases. The earlier power devices were driven by steam engines and with the perfection of the gasoline motor, that also was used. Then, of course, followed the electric motor and since its introduction it has been gaining steadily in favor wherever electrical energy is or can be made available. To the Italian government the use of electricity is especially favorable because Italy is totally dependent upon importation of fuels, while there are vast possibilities of hydro-electric development on the peninsula.

CONSIDERABLE progress has been made in Italy in the application of electricity to agriculture. One of the most unique and at the same time successful developments has been the electric plow. With electric costs comparable to energy charges in California, land is plowed, sowed and harrowed in Italy cheaper with electricity than in the Western states with tractors. ELECTRICAL WEST is indebted to the firm of Violati-Toscari Bros. for the information on which this article is based.

Three general arrangements of mechanical equipment for plowing are in use in Italy: the tractor, the indirect cable traction, and the direct cable traction types. The first, of course, utilizes the gasoline tractors so common in the United States, which have been imported into Italy in large numbers during the past few years. The indirect cable traction system has been used for many years and is shown schematically in Fig. 2. With this system the power-operated winch is set up at the corner of the field to be plowed and the cables are strung from double drums around the four sides of the field. As indicated in Fig. 2 the plow then is drawn back and forth across the field. As the plowing progresses furrow by furrow the movable anchor pulleys are advanced step by step until the entire field has been covered. Steam and gasoline engines also are used for this type of machine where electricity is not available, or where they have not as yet been supplanted by the electric drive. The driving motor or engine is belted to the winch as shown.

It is with the third class of plowing equipment, the direct cable traction type, that this article is concerned chiefly. This involves the use of two electric tractors, or "locomotives," a double-ended "balance" plow, about 1,150 ft. of ½-in. steel cable and about 300 ft. of 7/16-in. steel cable, and a portable transformer substation. The manpower required for the operation of the entire outfit is three, one at each locomotive and one riding the plow. This represents the latest development, apparently, and was perfected by the firm of Violati-Tescari Bros. of Milan along the general lines of the so-called "Fowler" scheme. A diagram of the arrangement is shown in Fig. 3.

The locomotives weigh about 6 tons each and comprise a 36-hp., 500-volt, 800-r.p.m. electric motor, a plow-cable drum geared down to 30 r.p.m. and capable of holding more than 400 yd. of ½-in. cable, and an operating switchboard. The motor is mounted on the forward part of the chassis, the drum in the center and the operator's cabin at the rear. All of the heavy parts are placed very low in order to give the units the stability afforded by low center of gravity. The operator's cabin is about 6 ft. high, but is made of light sheet steel. Better to resist the side pull incident to dragging the plow across the field, the four wheels are equipped with deep flanges.

At the front of the locomotive a second cable drum is located, connected also to the electric motor, but arranged through interlocks so that only one drum may be geared to the motor at any one instant. This second drum carries about 300 ft. of 7/16-in. steel cable which is used to "snake" the locomotive along the side of the field to its new positions as the plowing progresses furrow by furrow. Each locomotive advances while the other is pulling the plow. At the rear under the operator's cabin is a reel on which is carried the 3-conductor flexible steel-armored cable that is used to convey current from the portable substation. One of the locomotives is used always near the transformer station and carries only about 300 ft. of the 3-conductor cable, while the other one carries about 1,100 ft. to enable it

to work on the opposite side of the field. Thus one portable substation supplies two locomotives and one set-up permits about 600 ft. of travel for the plowing machine.

Power is brought from the main transmission lines over a system of feeder lines. Where feeder lines are not permanently installed a system of portable poles is used to carry a temporary line from the nearest feeder line. The transformers step down from the common line voltage of 15 kv. to 500 volts for the locomotives. To care for the poor regulation of the transmission lines and feeders, a commutator-type tap changer is installed with the transformer to enable the operator to keep the motor voltage fairly close to 500.

The first cost of the whole outfit, including the two locomotives, the balance plow, the portable transformer substation, the steel traction cables and the 3-conductor power cables, amounts to about $7,000 in American gold. Power costs are given as approximately 1.25 cents per kw.-hr., and, since under average conditions it is possible to plow about 7½ acres per 10-hr. day with the outfit above described, the power cost per acre is only about 40 cents. Even under difficult soil conditions, where the soil is thick, solid and of a clay base it is possible to plow more than six acres per day to a depth of 14 in. using two blades in the plow. With a single blade under the same conditions the same area can be covered and plowed to a depth of 20 in. with 2-ft. cuts. Average operating speed of the balance plow is about 210 ft. per minute. Fields are laid off so that the average width (length of furrow) is about 1,000 ft.

This type of plowing equipment has been found to be particularly well suited to use on soft, springy, or marshy ground where the direct-traction method using the common tractor would be impossible because of the

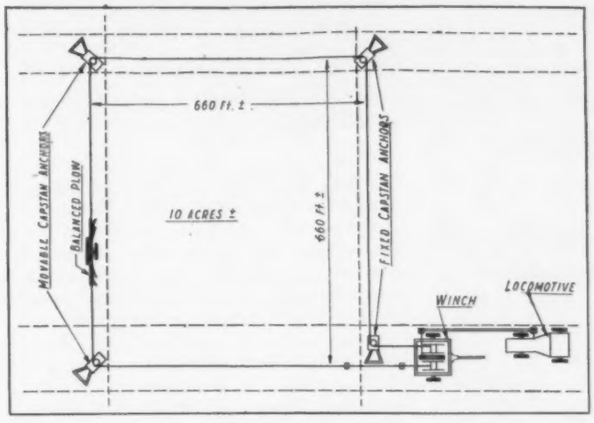


Fig. 2. Italian scheme of plowing with indirect cable system operated from a winch driven by electric motor or, in some cases, by steam or gasoline engine. It is possible to plow four 10-acre fields from one set-up.

inability of the soil to support the weight of the tractor. In using the cable plow in rice fields, for instance, the wheels are removed from the 1-ton balanced gang plow and skids or semi-pontoons substituted providing enough area to support the plow where it may be operating in soft mud, even under several inches of water. For such services, of course, the electric locomotives remain on driveways at the edges of the fields.

The Italian proponents of this general scheme of plowing claim that it not only lends itself to plowing under conditions prohibitive to other types of equipment, such as plowing rice field and others where the ground would not bear the weight of a tractor, but that the operating efficiency is increased materially because the locomotives do not have to haul their own weights back and forth across the fields. With the tractor-type of equipment the 3, 5, or 10-ton tractors use an appreciable portion of their power just to propel themselves back and forth across the field, while with the locomotive and cable layout the only weight in motion is the plow which weighs only about one ton.

Development of electric plowing in Italy has not been a path of roses, but like other similar efforts has passed through many discouraging stages, not the least of which were difficulties incident to finance. Early efforts to build up co-operative associations of farmers to finance experiments with and development of electric plowing failed. Subsequently there was formed a co-operative group of representatives of manufacturers of farm machinery, of the power companies, of the agricultural department of the Italian government and a few farmers whose interest was aroused. This group car-

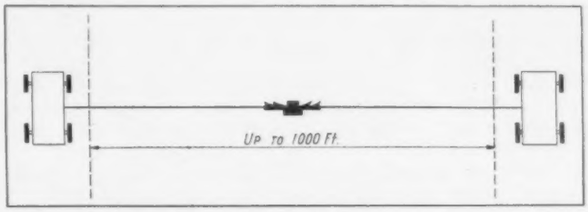


Fig. 3. Scheme of direct-cable traction in plowing. A double-ended balanced gang plow is drawn back and forth between the two electric "locomotives."

ried out the initial experiments and paved the way for the present healthy growth of "electroculture."

It was in 1918 that a group of manufacturers and agriculturists began work on the idea of uniting all of the farms in a given locality in order that through co-operative effort they could be provided with electricity for farming machinery. Within the scope of the scheme it was planned to establish a network for the distribution of electrical energy and to put this through, a great deal of promotion work was necessary and many grave difficulties had to be overcome. Not the least of the difficulties was the interesting of farmers to the point of financial support. This was about the last step accomplished. Initial experiments were carried on by means of special connections with available high tension lines through which power was supplied for those farms that were willing to try the experiment.

Thus it was that late in 1919 under the auspices of the promoting committee there were constructed the first few miles of electric lines operating at a potential of 15 kv. along the Navile Canal. Now in the region of Altedo, where the first experiments were carried on, there is a high tension distribution network comprising about sixty-five miles of line which serves a large percentage of the farms in that area.

As a result of this earnest co-operative effort the Electro Agricultural Corporation was formed in May, 1920, and this corporation is actively promoting the use of electricity for plowing and other farm uses. The corporation does business with the farmer on a basis quite similar to the traveling threshing outfits common in the wheat producing areas in the United States. The corporation arranges its equipment in such a way that it is able to do not only plowing but digging, harrowing, threshing, handling and drying rice, breaking up hemp, clearing rubbish and many other farm duties.

The corporation is able to do this work with electricity at a lower rate than that possible by any other mechanical energy, either steam or internal combustion. The total cost of plowing with the apparatus used by the corporation is $7.80 per acre, including labor. With gasoline or steam equipment the cost ranges from $8.10 to $10 per acre.

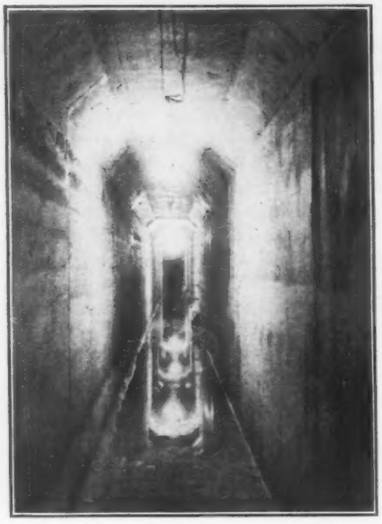
Engineering Practice

Circulating Water Tunnel Built in Four Sections

Pneumatic Caisson Method Proves Most Economical for Construction in Connection With San Diego Steam Plant Enlargement

By H. H. WATSON, General Superintendent of Construction, Byllesby Engineering and Management Corporation, San Diego, California.

TO PROVIDE for the expansion of its steam-electric generating plant, station "B," the San Diego Consolidated Gas & Electric Company was faced with the problem of constructing a new supply tunnel for conndenser cooling water from the bay. This construction involved crossing under four streets, several important railroad tracks and numerous water, gas and sewer lines, to say nothing of traversing filled ground in which were encountered many difficult obstructions, including two 5-ft. pipes under which the tunnel had to pass with no disturbance to the pipes. The entire length of 1,200 ft. was built by the pneumatic-caisson method, sinking each of the four caissons separately and subsequently connecting them together. It was necessary for the tunnel bottom to be 26 ft. below the street level in order to secure gravity flow from the bay to the circulating-pump intake. All methods were considered and weighed against each other with the result that the caisson method was selected as the most economical and likely of success with the least trouble. The selection proved well made.



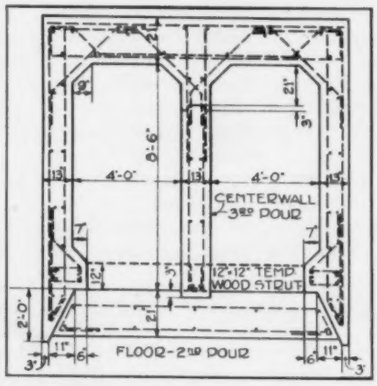
Interior view of one of the completed sections.

Excavation for each of the four caissons was carried down in open cut to the water line and then a section of the concrete tunnel was cast without a floor and with the bottom of the outside walls shaped to form cutting edges. After the concrete had set the caisson was compressed and excavation was carried on inside, the excavated material being deposited on top of the caisson, serving to assist in sinking. This method enabled workmen to remove obstructions as they were met, provided adequate protection for the old tunnels nearby and actually cost about 20 per cent less than the estimated cost of the steel sheet piling method, the next lowest in cost.

A caisson sunk to nearly full depth. Note backfilling from excavated material. One of the 4-in. ejector pipes may be seen dicharging in the background.

Although the completed tunnel was to consist of two 4 x 8½-ft. barrels the caissons were built with only a stub of the center wall, the shell being reinforced sufficiently to carry the stresses without the center wall or the floor when braced by temporary 12 x 12-in. struts just above floor level. These timber struts were placed horizontally on 8-ft. centers between longitudinal beams in the side walls and were removed after the concrete floor of the caisson had been poured. The 13-in. side walls were designed as slabs spanning from the roof of the tunnel to these longitudinal beams whose chief function was fulfilled during the construction period.

A concrete bulkhead was poured across one end of each caisson with the first pour of concrete. The opposite end was left open for the removal of forms, bearing planks, etc. When the concrete had set, forms had been removed and the section was ready for sinking, a luminite cement bulkhead was poured in the open end thus completing the fifth side of the caisson.



Cross-section showing design features of double-barreled tunnel.

Each caisson was equipped with 4 x 9-ft. air lock, which served as the main entrance to the caisson, and also with an emergency lock 4 ft. square. These air locks later were converted into manholes.

Short lengths of 6-in. pipe were cast on 16-ft. centers along the center line of the tunnel roof and extending above the top of the tunnel and below the uncompleted stub center wall. During the excavation period these pipes served as openings through which the 4-in. blow pipes were extended and later they were used for the delivery of concrete for the floor and center wall. As each caisson was lowered short lengths of pipe were added to these vents so they were kept always above the excavated material placed on the tunnel roof. These extensions were left as short as possible in order that there would be no unnecessary lift of excavated material.

When a caisson was ready for lowering excavation was begun on the inside and material was removed with a hoist bucket through the air locks until the shoes or cutting edges of the caisson were in 1 or 2 ft. of water. The caisson then was compressed, the water level forced down to a point slightly above the cutting edges, and the work carried on continuously in three 8-hr. shifts. Average pressures in the caisson were ½ lb. per sq.in. for each foot of hydrostatic head.

Excavated material was deposited by the workmen in troughs sloping down to the open ends of one of the 4-in. blow pipes. Each blow pipe was equipped with a quick-opening valve and a long-radius ell entering the lower end of the trough. By opening this valve for short intervals the material in the trough was ejected with only the air pressure within the caisson. Material blown out in this way was confined on top of the caisson by the walls of a wooden structure built up for this purpose before sinking began. By this method the caisson was backfilled as it was lowered. For the most part, sinking or lowering of the caisson was done once in 24 hr.; an average distance of about 6 in. per sinking.

Air pressure in the caisson was decreased to start the sinking process, the amount of decrease depending upon soil and water conditions. While the caisson was sinking, instrument men continuously took level readings on rods attached to the structure. Any unevenness was reported to the caisson foreman and a portion sinking too fast was retarded by placing wooden blocking under the shoe while a portion sinking too slowly was aided by additional excavation. When the sinking was retarded by exterior skin friction on the side walls a water jet was pushed down outside the wall to relieve it.

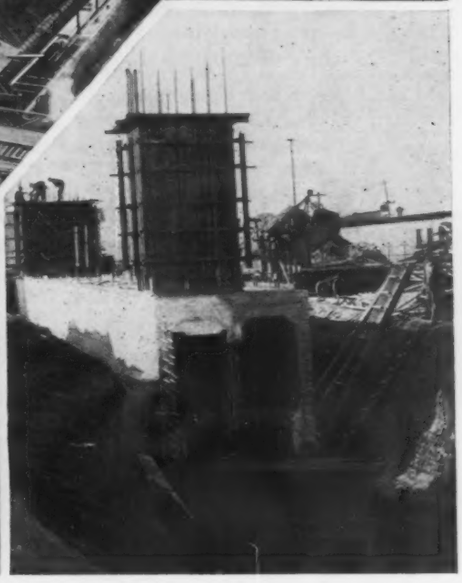
Air was delivered at low pressure to the caisson through a 6-in. pipe and high-pressure air was supplied through a 4-in. line. These pipes were connected to the caisson with a combination of swinging joints which permitted them to adjust themselves automatically as the caisson sank. The usual operation was to allow the full supply of low-pressure air to enter the caisson and to regulate caisson pressure by the amount of high-pressure air admitted. Controls were handled by the lock man on top of the main air lock. Each caisson also was provided with a safety valve of the lever-and-weight type to prevent any possibility of excessive pressure. The low-pressure and high-pressure lines supplying the caisson operated at 20 lb. and 100 lb. per sq.in., respectively.

In the excavation of clay or hard earth strata various equipment was used, including picks and shovels, pneumatic spades and gads and high-pressure jets of air and water. Old wooden piling and bulkheads encountered in the caisson were cut off a few inches at a time with sharp pneumatic chisels. Broken pavement, rock and pieces of solid substances were removed from the caisson by locking out through the emergency lock.

No data on similar subjects was found to aid in estimating the quantity of compressed air necessary for this work. It was considered advisable to supply not less than 30 cu.ft. of fresh air per minute for each workman in the caisson and high-pressure air was required, of course, for operating the pneumatic tools. Two motor-driven

Building backfill guides on one of the long tunnel sections preparatory to sinking it to final level. Air lock may be seen at near end and discharge pipes along the top.

General view showing No. 1 322-ft. caisson completed, backfill guides erected on No. 2 260-ft. caisson and forms under construction for No. 3 373-ft. caisson.



End view of caisson before sinking; forms stripped and open end ready for closure for compression. Note bracing timbers at floor line and reinforcing steel.

compressors were installed, each with a capacity of 500 cu. ft. of free air per minute. This capacity was sufficient ordinarily although occasionally the number of blowers that could be used for ejecting excavated material was limited by the air supply.

Caissons were maintained as level as possible during the sinking process to prevent undue strains that would crack the concrete. It was impossible, however, to prevent all cracks and when each caisson was compressed the interior wall and roof surfaces were given a cement wash coat with a brush. This sealed the pores, aided by the additional penetration resulting from the interior air pressure. When cracks appeared they were treated in a similar manner.

When each caisson was down to grade, blocking was placed under the shoes, the soil was leveled off and the excess water blown out. The floor reinforcing steel then was placed using the temporary 12 x 12-in. cross-beams for support. Before each caisson had been closed up and compressed the reinforcing steel was placed on the inside and tied in bundles on the side walls thus avoiding the slow process of bringing in the steel through the air lock.

For pouring the concrete floor the 6-in. pipes through the tunnel roof were extended about 10 ft. above street grade. A gate valve and hopper were attached to the upper end of these pipes and a special slide valve was put on the tunnel end. With this arrangement the hydrostatic head in the pipe loaded with concrete was greater than the air pressure in the caisson. Concrete thus was delivered without the use of any air-locking process and was spread manually to form the floor. When the floor was completed, air pressure was slightly increased and the caisson was maintained in this condition until the concrete had strength enough to carry the load. The center wall was poured with the caissons decompressed.

While one caisson was being sunk one adjacent was being constructed, a space of about 3 in. being left between the adjoining ends. When two adjacent caissons were in place with the concrete floor poured, holes were drilled in one of the concrete bulkheads and the space between was filled with grout which also was forced out around the exterior edges to form a rim or ridge around the joint. The bulkheads then were broken away and a depression was cut in the interior side walls to the first layer of reinforcing steel. This steel was straightened out, cut to the proper length and the steel from the two caissons tied together to form continuous sidewall reinforcement. Finally the interior surfaces of the walls were built up with a cement gun.

On the ocean end of caisson No. 4 approximately 75 ft. of the structure extended beyond the sea wall and this projection was to be supported on wooden piles driven to grade with a follower before the caisson was constructed. These piles were driven, enclosed by sheet piling and backfilled with sand to average water level. This procedure formed a support for the caisson similar to that in the trench excavated on the land side of the sea wall and sinking was done in the same manner as in the other sections.

The tunnel terminated at its outer end in a screen house containing trash racks, traveling water screens and bulkhead gate. Connections are so arranged that one barrel of the tunnel can be unwatered for cleaning purposes while the other barrel remains in service.

Work was done for the San Diego Consolidated Gas & Electric Company by the Byllesby Engineering & Management Corporation under the direction of H. H. Watson, general superintendent of construction.

Test Data on Edison 3-Wire System Shows Operating Advantages

By V. W. Palen

A RECENT test run on a d.c. 3-wire system netted some information that should be of interest to those operating such systems.

The 3-wire arrangement, of course, makes available 120 volts for lighting and 240 volts for power. It combines the two, eliminating one wire and reducing appreciably the losses in the neutral wire and on the system as a whole. There are several ways by which such a system may be derived. One of the earliest schemes was to connect two 120-volt generators in series as shown in Fig. 1(A). A 240-volt generator with a battery of storage cells across its terminals and with a tap off the midpoint of the battery [Fig. 1(B)] is another method of obtaining such a system. However, the generally adopted method of deriving the 3-wire system is by the use of a 240-volt generator supply utilizing two identical 120-volt generators, direct-connected through their shafts, in series across the line as in Fig. 1(C).

A motor-generator set thus used sometimes is called a compensator. This name originated from the fact that such an arrangement automatically compensates for any difference in the load on the 120-volt circuits. When the load becomes unbalanced on the system the machine across the lightly loaded side operates as a motor while the machine across the heavily loaded side operates as a generator.

For simplicity, only the armatures are shown in the circuit of Fig. 1(C). In Fig. 2, however, the fields are shown properly "cross-connected" and the various points where test readings of current and voltage were taken are indicated. All the readings made during the test on this system are given in Table I. Conditions ranging all the way from a perfect balance to extreme unbalance were used in obtaining this test data. Thus, by a study of the readings obtained, the characteristics of the system may be observed and conclusions may be drawn. In Figs. 3, 5 and 6 are illustrated particular sets of readings with the magnitude and direction of current indicated at each point.

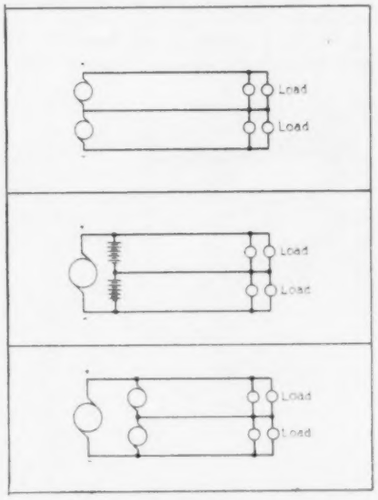


Fig. 1. Three methods of deriving a 3-wire system.

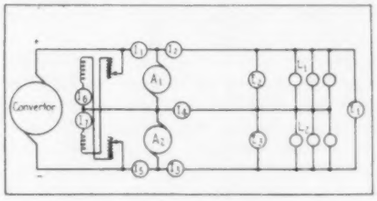


Fig. 2. Diagram of connections used in obtaining test data of Table I.

Since the path of current through a motor's windings is from positive (+) to negative (–) and in a generator's

TABLE I.

I_1	I_2	I_3	I_4	I_5	I_6	I_7	E_1	E_2	E_3
17	16	16	0	17	0.60	0.60	238	119	119
16.5	16	14	—2	16.5	0.60	0.60	238	118	119
15.5	16	12	–4	15.5	0.602	0.595	238	118	120
15.0	16	12	–4	15.5	0.602	0.595	238	118	120
14.5	16	10	–6	14.5	0.61	0.59	238	117	121
13.5	16	8	–8	13.5	0.62	0.58	238	115	123
12.5	16	6	–10	12.5	0.63	0.57	238	113	125
9	16	0	–16	9	0.65	0.55	238	109	129
16.5	14	16	+2	16.5	0.60	0.60	238	119	119
15	12	16	+4	15	0.595	0.602	238	120	118
14	10	16	+6	14	0.59	0.61	238	121	117
13.5	8	16	+8	13.5	0.58	0.62	238	123	115
13	6	16	+10	13	0.57	0.63	238	125	113
9.5	0	16	+16	9.5	0.55	0.65	238	129	109

windings from negative (–) to positive (+), the direction of current in each case indicates which machine is the motor and which the generator. An examination of Fig. 3 shows that the machine (A_2) across the lightly loaded side is operating as a motor while the machine (A_1) across the heavily loaded side is running as a generator. Thus, the motor adds load to the lightly loaded side and the generator helps to supply current to the heavily loaded side. In Fig. 5 the above conditions are reversed and the machine (A_1) is operating as a motor and machine (A_2) as a generator.

It is in this manner that the load on the two sides of the system is kept balanced. Operating experience shows that the motor-generator set thus used

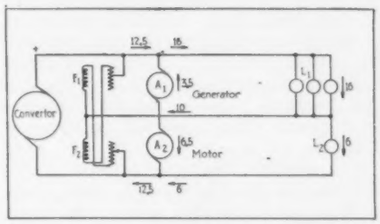


Fig. 3. Balancer machines A_1 and A_2 are mounted on a common shaft, the lightly loaded machine operating as a motor and the other as a generator.

pays for itself through the saving in losses. Take, for instance, the case shown in Fig. 5. If a 4-wire 120-240-volt system were used the losses for unit distance (d) would amount to $(6)^2\ (2d) + (16)^2\ (2d) = 584$ d. The losses with the scheme of Fig. 5 would amount to $(6)^2\ d + (16)^2 d + (10)^2 d = 392$ d.

Neglecting the slight losses of the motor-generator set the difference in losses between the 4-wire and 3-wire systems in this case is 192 d or a saving of 33 per cent. Besides the saving in

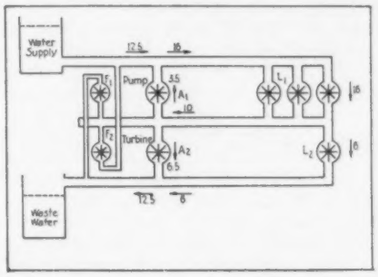


Fig. 4. A water analogy of Fig. 3, the lightly loaded machine operating as a turbine and the other as a pump.

losses there is a saving in copper of at least 25 per cent, since one wire is omitted entirely and since in most cases the neutral wire can be reduced in cross-section.

In Fig. 4 is shown a water analogy of Fig. 3, which may help to illustrate just what happens in the electrical circuit. In this case we deal with turbines and pumps instead of motors and generators, but the water flow through the various pipes is perfectly analogous to the flow of electricity in the wires and the load conditions determine which machine operates as a turbine and which as a pump.

There are several ways in which the fields of the compensator set may be connected. It has been found **least** satisfactory to connect them directly across their own armatures as shown in Fig. 5. Since the greatest voltage drop will occur across the terminals of the more heavily loaded machine the field excitation will be reduced proportionately and, since a decrease in excitation means a further decrease in voltage, conditions will tend to become worse. If, however, the fields are cross-connected as in Fig. 6, the voltage drop across the heavily loaded side will decrease the excitation (and therefore, the

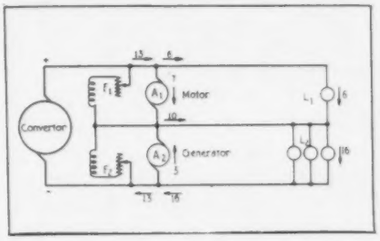


Fig. 5. Balancer machines A_1 and A_2 mounted on a common shaft, each with its field across its armature. A disadvantageous connection.

voltage) of the lightly loaded side. This action tends to maintain a voltage balance between the two sides of the system or, in other words, tends to maintain the neutral wire at its proper potential.

An examination of the data in Table I will disclose the fact that the values of field current are not constant. This, of course, is due to the variation of voltage on the two sides of the system. Thus, for instance, when the voltage E_2 dropped, the field current I_f also dropped. The variation of field current

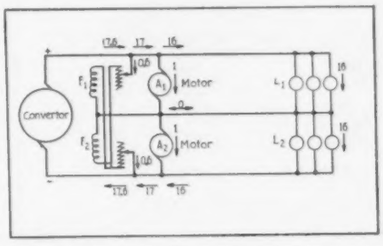


Fig. 6. Same as Fig. 5 except that fields of balancer machines are cross-connected. An advantageous connection improving voltage regulation.

and voltage are very much less than would result if the fields were "straight connected" as in Fig. 5.

Since the primary concern is with that which takes place in the armature and load circuits, the field current values have been omitted purposely from Figs. 3 and 5 since to include them would only complicate matters unnecessarily. An examination of Figs. 3, 5 and 6 shows that "the greater the load unbalance, the greater the neutral current." Further, "the greater the neutral current the greater the armature current." Therefore it is necessary to have the armatures sufficiently large to carry the maximum neutral current that may flow. With a well balanced system a relatively small compensator set will handle the situation.

In computing the power consumption in the various parts of the circuit shown in Fig. 2 the following formulas are used:

Power received from the supply
$= (E_1I_1) + (E_2I_7) + (E_3I_6)$
Power consumed by the load
$= (E_2I_2) + E_3I_3)$
Power consumed by the compensator set
$= (E_1I_1) + (E_2I_7) + (E_3I_6) - (E_2I_2) - (E_2I_3)$

Taking the third set of readings from Table I as an example:
Power received from the supply
$= (238)(15.5) + (118)(.595) + (120)(.602) = 3{,}831.45$ watts.
Power consumed by the load
$= (118)(16) + (120)(12) = 3{,}328.00$ watts.
Power consumed by the compensator set
$= (238)(15.5) + (118)(.595) + (120)(.602) - (118)(16) - (120)(12) = 503.45$ watts.

Stability of D.C. Motor Aided by Shift of Brushes

By E. J. Sacco,
Service Engineer, Westinghouse Electric & Manufacturing Company.

Speed surges to the extent of some 30 r.p.m. were found recently in a compound-wound 200-hp. d.c. motor driving a large circular rail saw in a steel mill. The field was checked to see that the series field was cumulative, by running the motor first as a series motor and then as a shunt motor, and rotation was found to be the same under both conditions. It was noticed, by sighting along the brush holders with respect to the center of the main pole, that the brushes had slipped off neutral in the direction of rotation a little more than one bar. When the brushes were moved back to neutral position the motor immediately settled down and ran with uniform speed, even at high speeds.

Due to the brushes being in advance of neutral the inter-poles were acting as a differential series field thereby weakening the main field flux with the result that the motor had a tendency to race. Windage losses in the circular saw consequently increased and this unstable condition caused the speed surges.

When the commutating coils are directly under the inter-poles (brushes on neutral) they have no influence on the speed. If the brushes were back of rotation, the motor would have been stable, but its regulation would have been bad since under this condition the inter-poles would aid the main poles. Brushes should be carefully set.

Analysis of Current Transformer Tests—XI

Discussion of Meter Connections—(*continued*)

By E. C. GOODALE, Tacoma, Washington

THIS "discussion of meter connections" was begun on page 150, Electrical West for March 1, 1928.

The following test shows the agreement of the "vector-average" law with test conditions in the case of two current transformers connected in series, bucking, on a 3-phase system. Fig. 35(A) shows the connections and numerical data while Fig. 35(B) gives the phase relations between all currents and voltages. Fig. 35(C) shows the distortion of the load voltages in this case of low current transformer ratios and low source voltages. This distortion is due to the relatively high reactance voltages built up in the current transformers. Had the current transformer ratios and source voltages been high, the distortion would have been very slight. In Fig. 35(D) is shown the derivation of the vector-average current, I_b. This agrees very closely with the actual test value of Fig. 35(B).

Phase relations of all quantities and their numerical values were determined by means of the voltmeter, ammeter, wattmeter, autotransformer, inductance coil and double-throw switch described in Article II in the April, 1927, issue of Electrical West. In this case the reference voltage was E_1, equal to 99 volts, assumed horizontal and to the right and the reference current 10 amp., in phase with it. The phase positions of all other quantities then were as shown in Fig. 35(B). In Table IX are listed the test data.

TABLE IX

	Volts or Amp.	Watts Switch Down		Cosine of Angle	Angle (Deg.)	Registration Switch Up	Lag or Lead
E_1	99	+ 990	+	1.0	0	Very slight change	In Phase
E_2	95	— 425	—	0.447	116	Increased Neg.	Lag
E_3	102	— 555	—	0.542	123	Decreased Neg.	Lead
E_A	60	+ 435	+	0.725	43	Decreased Pos.	Lag
E_B	60	+ 405	+	0.675	47	Decreased Pos.	Lag
E_C	Negligible in numerical value.						
E_{11}	95	+ 950	+	1.0	0	Slight change	In Phase
E_{22}	101	— 870	—	0.86	150	Increased Neg.	Lag
E_{33}	54	— 115	—	0.213	102	Slight Pos.	Lead
E_a	120	+ 800	+	0.666	48	Decreased Pos.	Lag
E_b	120	+ 800	+	0.666	48	Decreased Pos.	Lag
E_c	Negligible in value, per haps 0.2 volt.						
I_A	5.05	+ 290	+	0.58	55	Increased Pos.	Lag
I_B	6.3	— 595	—	0.955	163	Decreased Neg.	Lag
I_C	7.1	+ 310	+	0.442	64	Decreased Pos.	Lead
I_b	2.35	+ 223	+	0.96	16	Slight change	Lag

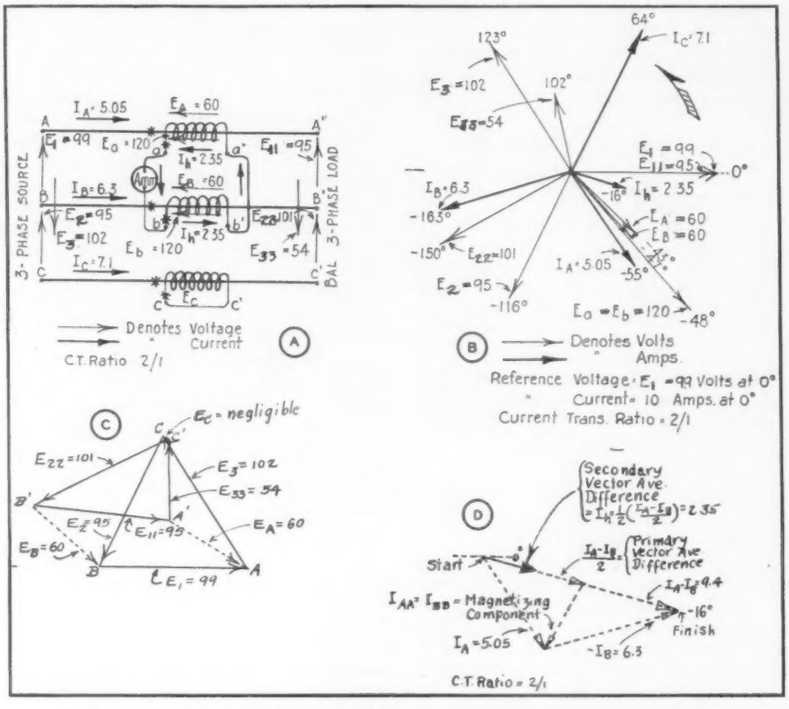


Fig. 35. Connection and vector diagrams illustrating steps in checking the "vector-average" law.

Static-Stability Limit Increased by Regulating Equipment

Significant increase in the power carrying capacity of a given transmission system is claimed to be possible with the use of regulating equipment described in a paper presented at the St. Louis A.I.E.E. convention, March 8, by C. A. Nickle of the General Electric Company. It is claimed further that the effective output of generators of given physical dimensions also may be increased through the use of the described regulating equipment.

The regulator is expected to make possible the operation of synchronous machines somewhat above the normal static-stability limit, heretofore the maximum point at which such equipment could be operated and still remain "in step." It is expected that with the type of regulating equipment described it will be possible to increase further the output ratings of machines of given physical proportions and to increase the economic distance of transmission at a given voltage beyond limits now feasible.

The results of tests made on a miniature set-up in the factory laboratory were presented in the paper. In these tests the power transfer between two similar synchronous machines connected to the same bus was increased about four-fold by the use of the described regulator, over that obtainable under hand-controlled steady state conditions.

When these same machines were separated by an artificial 500-mile transmission line the increase in power transfer obtainable by the use of the regulator above the steady-state value was approximately 25 per cent and was equal to about 90 per cent of the maximum theoretical power transfer over the line with an infinite bus at each end.

In principle this regulator permits the synchronous machine to operate in what is known as the condition of dynamic stability, in a power range hitherto unexplored because it lay beyond the limit of steady-state stability. The condition of dynamic stability may be illustrated by the analogy of a bicycle rider who depends for his balance upon the restoring forces initiated by his tendency to fall to one side or the other. The new regulator consists in general of a controlled system of generator excitation operated automatically by relays controlled by the generator terminal voltage. This system is similar to the usual scheme of voltage regulation, but with the additional novel characteristic of extremely sensitive and timely response to changes in terminal voltage. The rotor of the synchoronous machine thus regulated oscillates slightly about the dynamic stability point, being kept from dropping out of step by the restoring force of the field current controlled by the regulator.

The increased demand for power and the necessity for developing it in large quantities and transmitting it over long distances, have brought engineers to devote much attention to the study of stability limits.

Double-Range Ammeter for Ground Currents

Shop Modification of Standard Instruments Enables Accurate Indication of Small Currents

By L. L. CONRAD, Supervisor, Standardizing Laboratory, Test Department, Southern California Edison Company, Alhambra, Calif.

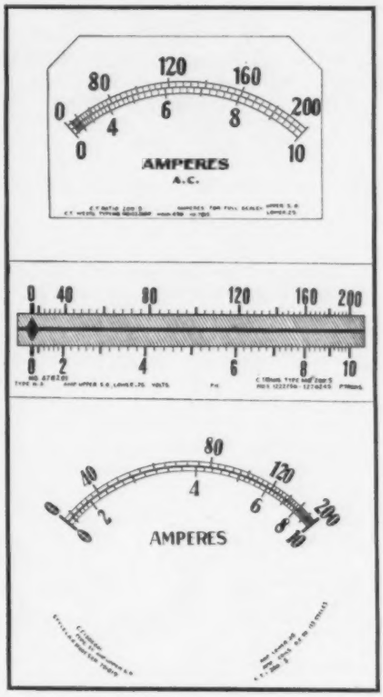
AS IT often is desirable to know the current in the grounded neutral of a bank of power transformers under normal operating conditions, and where a large capacity current transformer is permanently installed in the neutral, a special double-range ammeter may be used to advantage. The nominal ratio of the neutral current transformer usually is of such a capacity as to provide adequate ground conection for abnormal conditions imposed upon the transformer bank during short circuits on the transmission lines.

Switchboard ammeters, of course, are designed and scaled for full-scale deflection at the nominal full load rating of the current transformer with which they are to be connected. Under normal operating conditions this combination of current transformer capacity and the large current values represented by each scale division does not permit anything more than a slight deflection of the ammeter pointer when small ground currents exist.

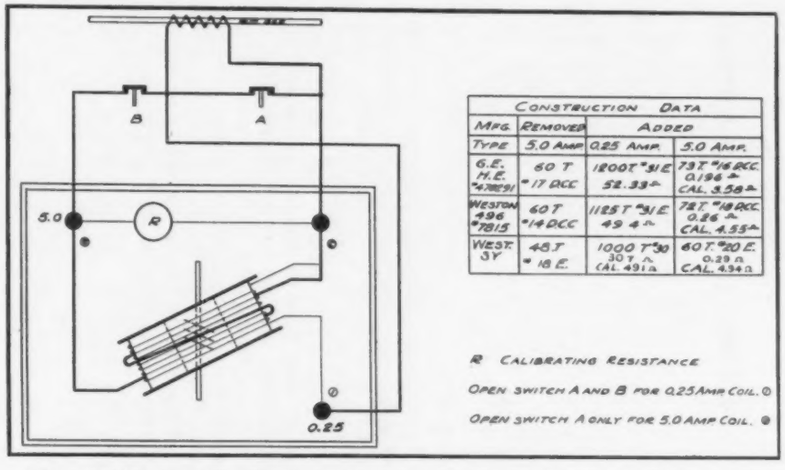
Accurate indications of these small ground currents often are valuable in the operation of a large network system. The use of an additional current transformer of a lower capacity would provide an accurate indication of the smaller values of ground current, but it is obvious that a short circuit or a heavy unbalanced condition on the line would damage such an installation, necessitating frequent replacements.

To provide an inexpensive device for this purpose an ammeter has been developed in the test department of the Southern California Edison Company which meets all the field requirements as specified by the protection engineering department of that company. Weston Model 496, General Electric horizontal, and Westinghouse SY standard switchboard type, 5-amp. ammeters have been modified by removing the 5-amp. winding from the field bobbin and rewinding with two separate windings.

The original 5-amp. winding of approximately 60 turns of No. 14 double-cotton-covered magnet wire is replaced with 1,200 turns of No. 31 bare enameled wire for the low-range (0.25-amp.) coil 1, also 72 turns of No. 18 double-cotton-covered magnet wire for the high-range (5-amp.) coil 2. Calibration spools are installed in parallel with the 5-amp. coil and a third connection post provided for it.



Reproduction of double-range scales as applied to standard instruments.


B
A
5.0
R
0.25
CONSTRUCTION DATA
MFG. | REMOVED | ADDED | |
TYPE | 5.0 AMP | 0.25 AMP. | 5.0 AMP.
G.E. M.E. #78191 | 60 T #17 DCC | 1200T #31E 52.33Ω | 72T #16 RCC 0.196Ω CAL. 3.58Ω
WESTON 496 #7815 | 60 T #14 DCC | 1125T #31E 49.4Ω | 72T #18 RCC 0.26Ω CAL. 4.55Ω
WEST. SY | 48T #18 E. | 1000T #30 30T Ω CAL. 491Ω | 60T #20 E. 0.29Ω CAL. 434Ω
R CALIBRATING RESISTANCE
OPEN SWITCH A AND B FOR 0.25 AMP COIL. ⊙
OPEN SWITCH A ONLY FOR 5.0 AMP COIL. ●

Schematic diagram of connections and arrangement of modified standard instruments.

Similar modifications have been made to General Electric horizontal Weston Model 496 and Westinghouse SY ammeters with similar characteristics. Results are shown in the accompanying reproductions of actual scales taken from instruments now giving satisfactory service.

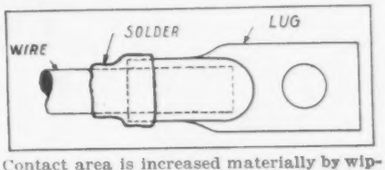
In each contemplated installation an ammeter and current transformer of the proper nominal capacity is sent to the standardizing laboratory for reconstruction of the instrument and scale calibration with the current transformer under field conditions compensating for all errors due to ratio and secondary burden. A schematic diagram of the internal windings and connections is shown herewith.

Switches A and B normally are closed, thus short circuiting the current transformer secondary leads. Opening switch A removes the short and provides a parallel circuit through coils 1 (0.25-amp.) and 2 (5-amp.) for a maximum deflection of the pointer at nominal full load capacity of the current transformer.

Opening switches A and B removes the short and permits current through coil 1 only. The total current in the secondary of the current transformer flowing through the 0.25-amp. winding gives a full-scale deflection of the pointer at 5 per cent of the nominal full load capacity of the current transformer. Thus an accurate reading of the ground current under normal operating conditions is possible.

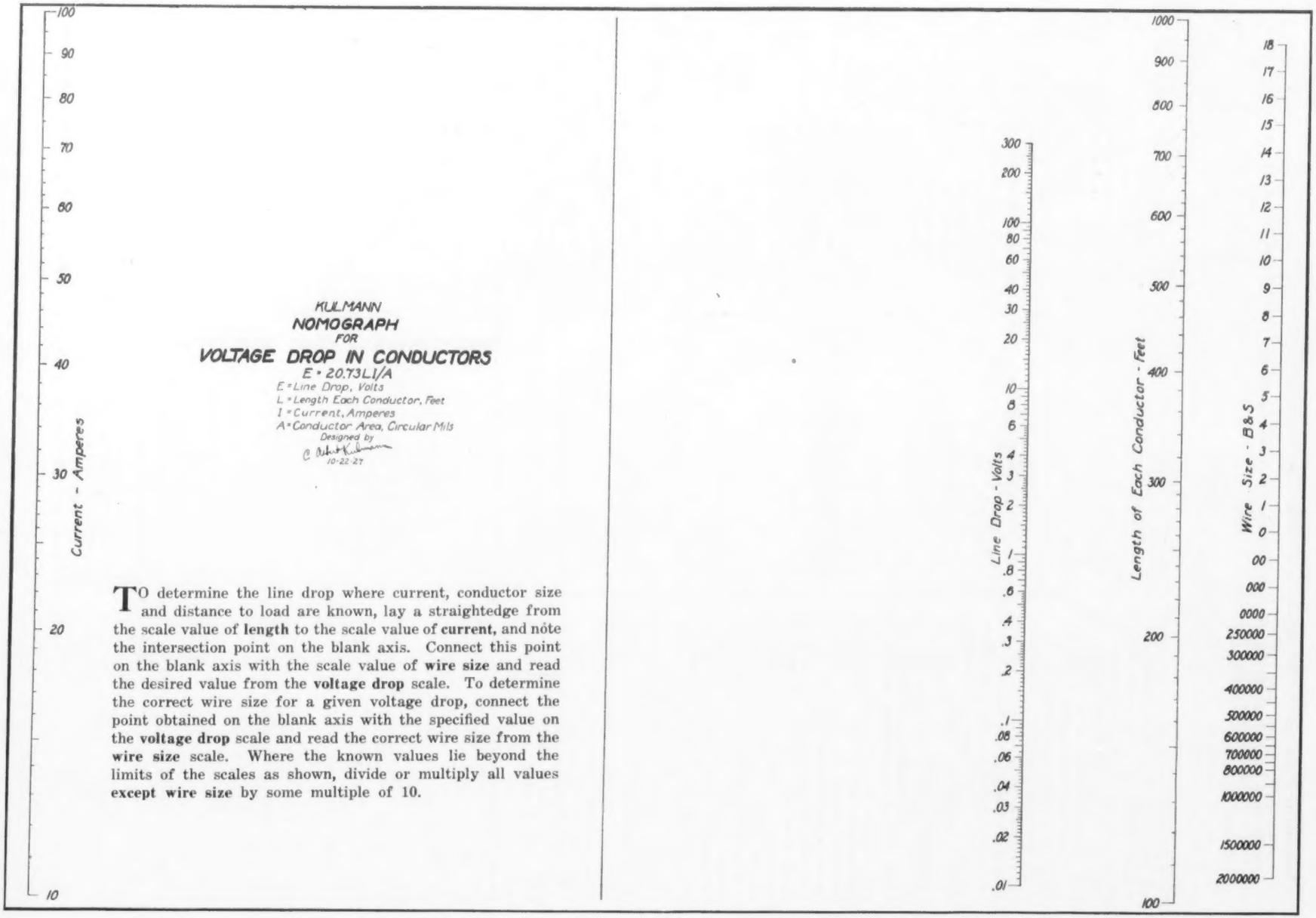
Contact Efficiency Increased by Wiping Lug Connections

To reduce contact resistance and consequent heating of lugs at pothead, bus or other connections, the underground engineers of the Puget Sound Power & Light Company have evolved a method of wiping the joint. This greatly increases its efficiency. As indicated in the accompanying sketch, the contact area and consequently the area through which current may pass from the conductor to the lug is increased perhaps as much as 100 per cent.



Contact area is increased materially by wiping the connection between conductor and lug.

Resistance reduction effected by the wiped connection has been found to remove practically all pothead and lug trouble where previously the heat under heavy loads caused the melting of solder. Of course in inverted lugs the softening of solder might even cause an interruption to service. The cost of wiping the lugs is entirely negligible considering the increased contact efficiency.



To determine the line drop where current, conductor size and distance to load are known, lay a straightedge from the scale value of **length** to the scale value of **current,** and note the intersection point on the blank axis. Connect this point on the blank axis with the scale value of **wire size** and read the desired value from the **voltage drop** scale. To determine the correct wire size for a given voltage drop, connect the point obtained on the blank axis with the specified value on the **voltage drop** scale and read the correct wire size from the **wire size** scale. Where the known values lie beyond the limits of the scales as shown, divide or multiply all values **except wire size** by some multiple of 10.

Nomograph for the Determination of Voltage Drop in Conductors

By C. Albert Kulmann*, Palo Alto, California

SIMPLIFIED and accurate determination of the various factors related to the voltage drop in transmission and distribution conductors may be accomplished through the use of the nomograph shown on the opposite page. The chart is based upon extensive mathematical operations and is physically arranged in such a manner that great accuracy in results may be realized with nominal care in its use.

This alignment nomograph is based upon the resistance of copper conductor per mil-ft. and the value used is 10.37 ohms as given by the Copper and Brass Research Association. Various other values are given, but 10.37 ohms checks closely with the actual resistance as given in various handbook tables. The two conductors of a circuit usually are parallel and therefore the constant was doubled to give 20.73 ohms as the resistance per mil per foot of distance.

The equation used is

$$E = \frac{20.73\ LI}{A}$$

where **E** is the voltage drop in the line, **L** is the length of one conductor or the distance to the load, **I** is the current carried by the line in amperes, and **A** is the area of the conductor in circular mils.

In order to determine the line drop where current, size of conductor, and distance to load are given, lay a straightedge from the scale value of length to that of current, and note the intersection point on the blank axis. Connect this point with the scale point of wire size and read voltage drop from the voltage drop scale. To determine the correct wire for a specified drop, connect the point obtained on the blank axis with the scale value representing the specified drop and read wire size from the wire size scale.

Where given data lies beyond the limits of the scales, divide or multiply any value except wire size by some power of 10. For instance, to find the proper wire to give a drop of two volts where the distance is 400 ft. and the current is 8 amp., connect scale points for 80 amp. and 400 ft. and note the intersection with the blank axis.

Obviously, since the scale value for current is 10 times the actual value, the drop for any given conductor will be but one-tenth that shown on the chart; consequently the point on the blank axis is connected with a voltage-drop scale value of 20 and the wire size is read off directly as slightly larger than No. 5, so No. 4 probably would be used.

Editor's Note. This the first of a series of useful nomographs prepared by Mr. Kulmann from experimental and mathematical data. Others will appear in subsequent issues of Electrical West.

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Underground Cable Creepage Eliminated by Flat-Grade Duct Lines on Hills

A SUGGESTED method for overcoming the creegage of underground cables installed in hillside duct lines is shown in the accompanying sketch. Through the use of this scheme it will be possible to maintain a constant maximum grade of 0.5 per cent regardless of the steepness of the hill to be negotiated by a duct line.

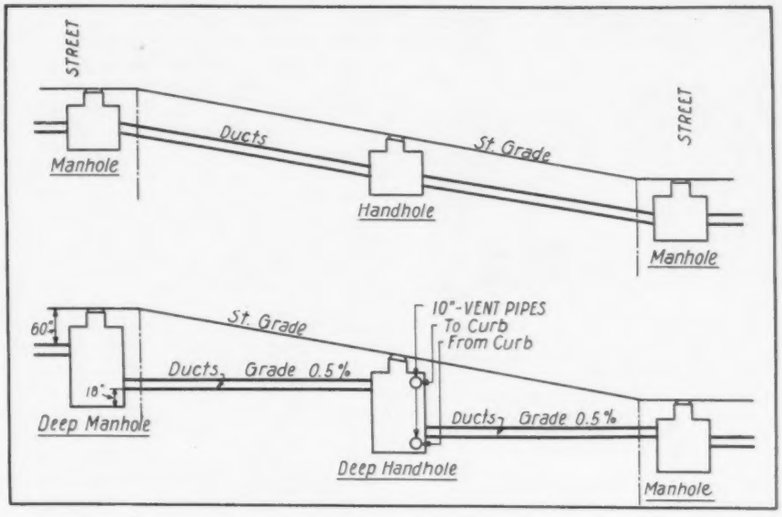
Operating difficulties experienced with underground cables installed in steep duct lines has caused the underground engineers of the Puget Sound Power & Light Company, Seattle, to evolve this scheme. When cables are installed in steep lines there is a tendency for continuous downhill creepage resulting in cable damage at the uphill ends of runs. Careful investigations have shown that no continuous creepage occurs in grades of 0.5 per cent and also that a grade of this amount will provide sufficient drainage and ventilation.

In most cases the new plan will involve no more vaults or manholes than the old steep street-grade scheme, the distance from street-center to alley-center being such that the required depth of manhole is not excessive. To maintain a minimum clearance of 5 ft. from the top of the duct line to the street surface a maximum manhole depth of about 22 ft. will be encountered in the establishment of this kind of scheme in certain portions of Seattle. This depth allows a space of 18 in. between the lower edge of the duct run and the floor of the manhole. The average duct run is about 15 conduits, the minimum 4, and the maximum about 20.

The increment in construction cost of the proposed "constant grade" scheme over the cost of the old street-grade scheme is comparatively small and the operating results to be obtained are relatively much more satisfactory.

Using hand methods of construction for a vault 8 x 22 x 8 ft., the average labor requirement is 48 man-days while with Ingersoll-Rand digging tools for the same size vault the labor is just half, while the additional cost of operating the machine is only about $7 per day. The average crew used with a machine constitutes two men trenching, two men throwing, two men loading, and two men relaying where the depth of the trench or hole requires the relaying of excavated material to the surface. For the deep trench and particularly the deep manholes required in the new scheme it is proposed to construct an elevating machine that will reduce by 50 per cent the cost of getting the excavated dirt out of the manhole.

Ventilation for all manholes is provided by means of 10-in. pipes carried both from the top and the bottom of the vault over to the curb line. The 10-in. pipe has been adopted as a standard to reduce the stock necessary because it has been found that the cost of installation of small and large pipes is essentially the same and that the larger pipes give a much more satisfactory ventilation. Poor ventilation has been the cause of much vault trouble.



A scheme of underground construction for hill districts (lower) that affords economic solution to the creepage difficulties normally encountered in steep runs (upper).

Ideas for the Contractor

Circuit Breaker Enters the Residential Field

Set for Average Demand, Device Cuts Customer's Minimum and Provides Service Switch of Many Advantages, Especially With Heating Loads.

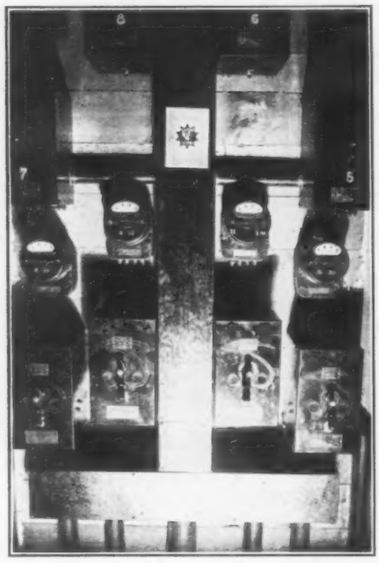
CIRCUIT breakers, a commonplace in industrial applications, seemingly have found a place in home wiring which it will repay the contractor to investigate and perhaps develop.

While the circuit breaker costs many times as much as the ordinary switch its many advantages, especially in electric heating installations, make it worth while investigating by the contractor in order that he may convince his customer of its desirability.

The particular application which has brought this device into focus in a new connection in southern California has been in the Red Seal apartment house built recently by George Fruehling at 708 North Sycamore St., Los Angeles.

Each of the eight apartments is fully electrically equipped and has a connected load of approximately 16 kw.

The reason for the circuit breaker installation in this case is given by R. M. Frye, Electragist, who made the installation, as one of economy to the occupant of the apartment. A diversity factor on the electric equipment in use in each of the apartments indicated that although there were 16 kw. of connected load a maximum of 10 kw. at any one time would be the average demand. Therefore a minimum monthly rate based on a 16-kw. demand, especially for the apartment user, would require an $8 per month minimum whereas for a 10-kw. demand a $5 minimum would suffice.



The mounting of circuit breakers and meters in the switch cabinet. Each apartment has its individual circuit breaker and meter.

The circuit breaker was resorted to as a means of limiting the load at any one time to a maximum of 10 kw. Circuit breakers were tested by the power company and set and locked by them at 10 kw.

Considering the difference in monthly minimum over the period of a year, the extra cost of the circuit breaker would be made up during that period alone.

Advantages

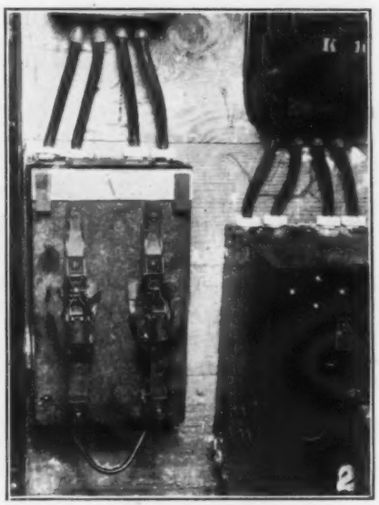
Other advantages of the circuit breaker as against the ordinary service switch at once became apparent from the installation. The circuit breaker having overload and no voltage release features makes a service switch for an installation of this kind which is far better than the ordinary. The circuit breaker cannot be over-fused or the fuse jumped by means of copper wire. When the circuit is open there is nothing hot exposed except the two carbon contacts at the top of the breaker and adjustments can be made to the equipment in perfect safety.

One particular advantage in the case of an electric heating load is found in the fact that due to the character of a heating load the entire wiring becomes a part of the heating system. With the ordinary knife-switch, especially of the type often installed, the maximum rated capacity of the switch is based upon a momentary rise in temperature due to an overload. Very often switches are not designed to withstand long heating due to a constant load. The fuses in effect become heaters themselves and the switch and fuse clips very often heat to such an extent as to lose their spring effect and become inefficient and dangerous. With circuit breakers, on the other hand, the protection to the line is not due to a heating effect as is the case with a fuse. Breaking of contact is dependent in this case upon the magnetic effect entirely.

Each of the Fruehling apartments is equipped with a 6.8-kw. Standard range, one 3,500-watt air heater, thermostatically controlled, a 2,500-watt heater, a 1,200-watt heater, one 2,000 and one 1,000-watt water heater, all of Apfel make. Each apartment is also furnished electric refrigeration from a central refrigeration unit in the basement.

From the power company's standpoint the use of the circuit breaker is highly recommended by the Los Angeles Gas and Electric Corporation, upon whose lines this installation was made. Because of a definitely limited demand the power company can keep it under control. The transformer capacity furnished to the installation can be limited to that of the circuit breaker setting. The power company can seal the circuit breaker as it does a meter.

From the customer's standpoint rather than having to re-fuse when a circuit has been overloaded a simple turn of a handle places the circuit back in use immediately. This also saves on trouble calls to the power company for fusing. The cost of fuses is also saved.



The circuit breaker with the can removed. The knurled nuts seen at the base of the circuit breaker are used to set it for the maximum load it will carry without opening. The capacity of this breaker is from 40 to 90 amp.

The load limiting as well as the safety and convenience features of the circuit breaker should bring it into a still greater field of usefulness, the home or residential field.

Outline of California Electragists' Activities

As Given by State Manager at Both Northern and Southern Division Meetings as the Basis for a New Membership Drive

BECAUSE during the past few weeks some discussion as to the scope of activities of the California Electragists has arisen a detailed account of the work as outlined by C. J. Geisbush, state manager, at both the Northern Division and Southern Division conventions, will serve to clear up many misunderstandings. Mr. Geisbush described the work of the association in order to give to both members and non-members as well as to representatives of the other branches of the industry present a clear-cut idea of the benefits which the contractor-dealer could derive from the association.

A membership drive, in which all branches of the industry are to participate, is being planned for the month of May. If the work of the Electragists is understood better by every individual in the electrical industry, it is the contention of leaders in the industry, the message of the benefits of the organization can be carried more convincingly to non-members.

Describing the affiliation of the California Electragists with the Association of Electragists, International, whereby the services of the international organization staff are made aivailable to the local members, Mr. Geisbush went on to show the many phases of the contractor-dealer's business which could be aided by the association. The first point covered was that of:

Organization

General

(1) Assistance in organization of local groups is given any group of members desiring it so that local situations may be handled to best advantage by concerted local thinking and action.

(2) Model constitution and by-laws are provided for such groups to assist in forming working organizations of their own.

(3) Local field representatives or secretaries are trained or assisted by the state staff men.

(4) Conferences of secretary-managers are held at which ideas for the improvement of local groups and for the benefit of individual members are discussed. These meetings exchange information of national as well as of local importance.

(5) Model ordinances are supplied to local groups to offer to their civic authorities for adoption. The association is co-operating with the California Association of Electrical Inspectors in fostering its uniform or standard ordinance and in its efforts for county as well as state ordinances, to bring up to National Electrical Code standard wiring done outside of areas at present covered by ordinance.

(6) A code of ethics is set down for all members to abide by and for all local associations to adopt.

(7) A bureau of information is maintained, both nationally and at the state offices through which members may gain information pertaining to their business.

(8) Improvement of competition is sought by constructive methods, seeking to build up the members' business knowledge and standing rather than attempting artificial or uneconomic restrictions of trade.

Specialized

(1) **The Estimators' Section** brings together estimators for the study of their profession. These groups study estimating methods, labor costs, etc., and seek to improve their relations with engineers and architects for the more accurate preparation of specifications and plans. (See Journal of Electricity, June 15, 1926, p. 578.)

(2) **The Motor Section** has been organized to bring together motor dealers and motor specialists (those who maintain repair shops for rewinding and repairing motors and motor control equipment) for mutual discussion of their problems and for improvement of the motor market. (See Electrical West, September, 1927, p. 156, also March, 1928, p. 179.)

(3) **Merchandising Section** activities have embraced a study of range wiring standardization as well as provided traveling institutes to bring to members better methods of merchandise display and selling.

That other branches of the industry may know the extent of this association's activities and assist in getting new members to join its ranks for the general improvement of the industry, this report is made particularly complete.

(4) **Residence Wiring Sections** are studying the costs of doing this type of construction, striving to improve ruinous competitive conditions by education on costs, overhead, etc., and seeking for competition along lines of improved jobs rather than skimped jobs. Red seal homes are the objective of this activity.

(5) **Joint trade groups** are brought together to iron out misunderstandings as to policies or methods and for the improvement of relations between various branches of the industry. Mutual problems, such as credit and accounting, in which the interests of both contractors and jobbers are involved, are typical of subjects studied. (See Electrical West, Oct. 1, 1927, p. 225.)

Technical Service

Estimating—Through the technical staff of the A.E.I. the member is furnished:

1. Cost data on wiring methods employing: (a) rigid conduit; (b) flexible conduit; (c) armored cable; (d) metal molding; (e) knob and tube; (f) motor installation.
2. Estimating forms scientifically designed to carry all information.
3. Individual advice as to any specific estimating problem.
4. Classes in estimating to familiarize the contractor with the Electragist system and aid in improving his own methods.

Research—Constant research is being conducted by the technical staff to gather more working data on:

(1) Job control methods; (2) cost analyses; (3) studies of new methods, new tools, efficiency of equipment; (4) wiring methods by means of national surveys.

Business Service

Accounting—The barometer of a successful business is its accounting system, and there is under way this year especially a widespread activity to improve the business of members by educational work in accounting. This is aided by:

1. A standard accounting system for both the contracting and merchandising departments, worked out by co-operation with national manufacturers, national jobbers and national Electragist experts.
2. Job record forms, designed to keep all essential information.
3. Price records, whereby comparisons can be maintained.
4. Uniform proposal forms for the presentation of bids.
5. Time record forms, for analysis of labor costs.
6. Profit and loss forms, for summarizing and arriving at precentages of costs to profits, etc.
7. Overhead analysis forms, making easy the close scrutiny of this important cost of doing business.
8. Educational classes, carried into the field to bring an appreciation of the necessity for accounting to the contractor-dealer business.

Statistics—In the running of any business statistics are invaluable as guides for action. The association provides statistical information to members on (1) overhead data; (2) wage rates; (3) inspection data; (4) engineering data. Bulletins are issued periodically giving this information.

Accounting Supervision—Services of an authorized Electragist accountant are offered members at nominal charge for the installation of a complete cost accounting system, and weekly, monthly or semi-monthly service in checking up on the books is available.

Industry Service

Representatives of the A.E.I. are on the National Electrical Code committees, representing the contractors in the establishment of minimum wiring standards.

Trade policy studies are entered into by means of contacts with jobbers, manufacturers and central stations, both as to the state and nationally.

Standardization work is fostered in the interest of all branches of the industry.

A higher standard of wiring is being sought through the establishment of the "Electragist Standard of Wiring," which can be sold on a quality and adequacy basis rather than accepting the Natinal Electrical Code, really a minimum standard, upon which to bid for jobs.

Legislation affecting contractor-dealers is watched at state and national capitals.

Representatives sit on the council of industrial relations, which arbitrates industrial disputes.

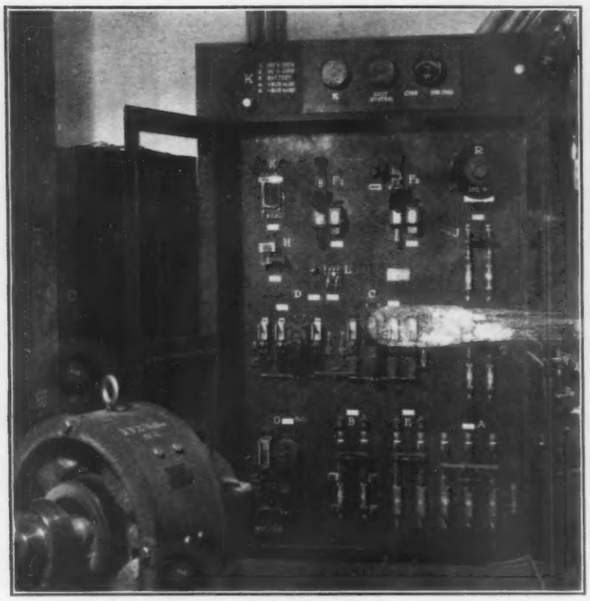
Speaker representatives give the Electragists' side of industry problems at national and state meetings of other branches of the industry.

The organized strength of contractor-dealers is maintained by leadership and watchfulness of their interests.

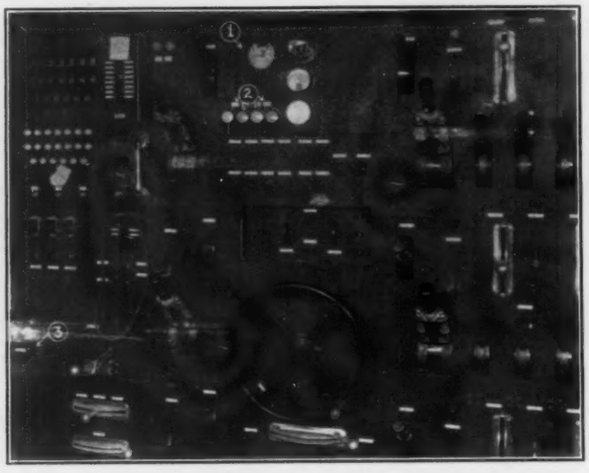
In concluding his presentation of the ramifications of the Electragists' activities, Mr. Geisbush very emphatically set forth the policy of the organization as one of constructive effort only. He stressed the fact that the contractor-dealer branch of the industry cannot be expected to have better conditions, that the general situation of the contractor-dealer with respect to the industry as a whole cannot be improved until the contractor-dealer has become a better business man and his business has improved. This, he pointed out, can only be accomplished by constructive self-education.

"We are working hard for a united industry in every sense of the word," declared Mr. Geisbush, "and we are using the most constructive methods we know of to attain that end."

Red Seal in British Columbia.—According to J. Hart, secretary-manager of the Electrical Service League of British Columbia, there are now 434 Red Seal houses in and around Vancouver. In addition to these, Red Seal certificates also have been awarded to eleven apartment blocks and to one duplex house. During 1928 Mr. Hart intends to continue his Red Seal campaign amongst owners of new houses as well as to institute a rewiring drive, to be followed at a latter date by a renewal of electrical fixtures campaign.



Left: Contactor panel for a theater emergency lighting system. Interlocking contactors shown marked "D" and "C." Right: Pro-



jection room switchboard controlling house and stage lighting, showing equipment dealing with emergency system. Large switch under the wheel is the throw-over switch from "normal," as seen in the picture, to "battery emergency" at the left. (1) The ampere-hour meter which gives an indication of the battery reserve conditions. (2) Pilot lights indicating, left to right, "Exits, A.C.," "Exits, D.C.," "M.G. set signal" and "Danger, Battery open." (3) Push button, with pilot indicator above, for starting 90-volt motor generator set on the emergency system. An emergency lighting control also is located in the box office.

Theater Emergency Lighting—the "Why" for the Rules

Pacific Underwriters' Requirements Explained by One of the Engineers Who Assisted in Their Revision for Modern Conditions

By JAMES M. EVANS, Electrical Engineer, Board of Fire Underwriters of the Pacific, Los Angeles.

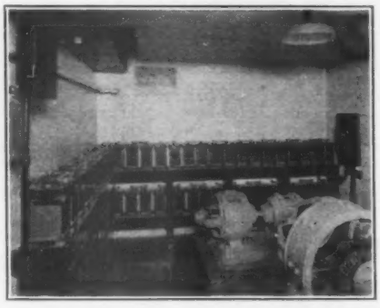
DURING the past 100 years about 1,500 people, most of whom were children, have been killed in the United States in theater fires and panics due to false alarms. This number does not include those killed by the collapse of theater buildings and is more than the total for all other parts of the world.

The worst part of the whole matter is that whereas reasons can be advanced why the loss of life occurred, there is no excuse that need be entertained. Fifty years ago the methods of constructing and equipping a theater were fairly well understood and now are clearly laid down in the National Building Code and other publications. If there is a panic in a theater building and anyone is killed, it is because someone balanced dollars against lives.

A New Hazard—Film

The National Building Code, however, does not touch upon the new hazard that has arisen during the last few years. Fifteen years ago theaters were just beginning to appreciate the value of electricity for lighting, but now 95 per cent of all theaters and many schools and progresisve summer and winter resorts have installed the necessary equipment, not only for lights but also for motion pictures. Properly handled, electricity will introduce some hazard, even though the wires are installed in conduit. In connection with a high explosive such as film, the risk is great. Daily fires indicate how great is the danger in places showing pictures by means of the ordinary professional or nitro-cellulose film.

In order to reduce the electrical hazard to a minimum the California Industrial Accident Commission in 1920 published certain rules which were accepted as being the minimum for wiring which was safe in theaters. But when their last code was published these rules were omitted except for a few covering certain features of the projection room.



Storage battery and charging set for a large theater emergency lighting system.

The insistent demand for a set of regulations could be best met by action of the state government. Since this could not be obtained, the Board of Fire Underwriters of the Pacific, with offices in San Francisco and Los Angeles, was called upon to promulgate a code that would give adequate protection and still be only a minimum requirement. The board had had a small pamphlet published in 1912. This had long been out of print. It was therefore thought best to publish a revised edition of this pamphlet with just enough additions to cover the changes in practice evolved since that time. Such a pamphlet is now available and in fact has been given wide distribution among all interested contractors, inspectors, architects and engineers.

In this code it has been recognized that exit lights are not emergency lights in the true sense of the word, yet as they should be connected to those special circuits required by emergency lighting, they are included in the definition.

Classifies Theaters

For general convenience and standardization, theaters are divided in accordance with their classification in the National Building Code. Theaters seating more than 300 persons are considered as being in the same general classification as to dangerous hazard; those of less capacity in another group. In theaters seating more than 300 patrons, special precautions should be taken to see that the audience may be evacuated quickly and easily from any place of danger. These precautions should apply to all theaters of this group and vary only in degree with the number of people allowed within the building. In

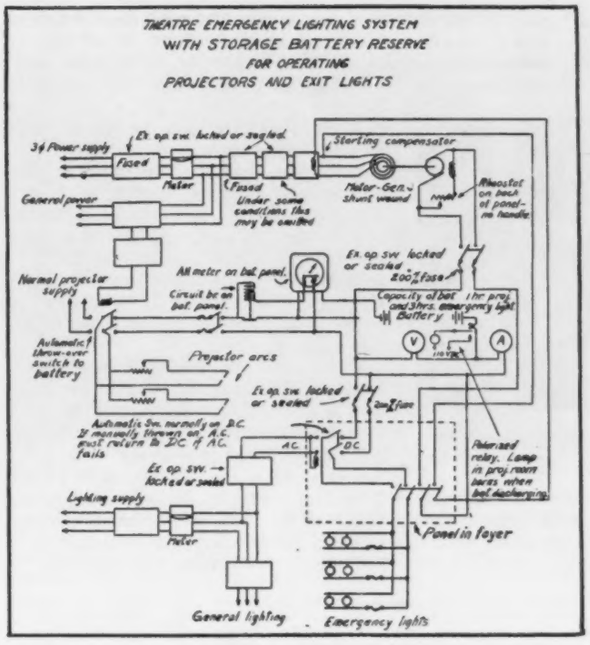

THEATRE EMERGENCY LIGHTING SYSTEM
WITH STORAGE BATTERY RESERVE
FOR OPERATING
PROJECTORS AND EXIT LIGHTS
3ϕ Power supply
Fused
Meter
General power
Starting compensator
Motor-Gen. shunt wound
Rheostat on back of panel—no handle
Under some conditions this may be omitted
Normal projector supply
All meter on bat. panel
Circuit breaker on bat. panel
Capacity of bat. 1 hr. proj. and 3 hrs. emergency light Battery
Automatic throw-over switch to battery
Projector arcs
Ex. op. sw. locked or sealed
Automatic Sw. normally on D.C. If manually thrown on A.C. must return to D.C. if A.C. fails
A.C.
D.C.
Polarized relay. Lamp in proj. room burns when bat. discharging
Lighting supply
Panel in foyer
General lighting
Emergency lights

Fig. 1.

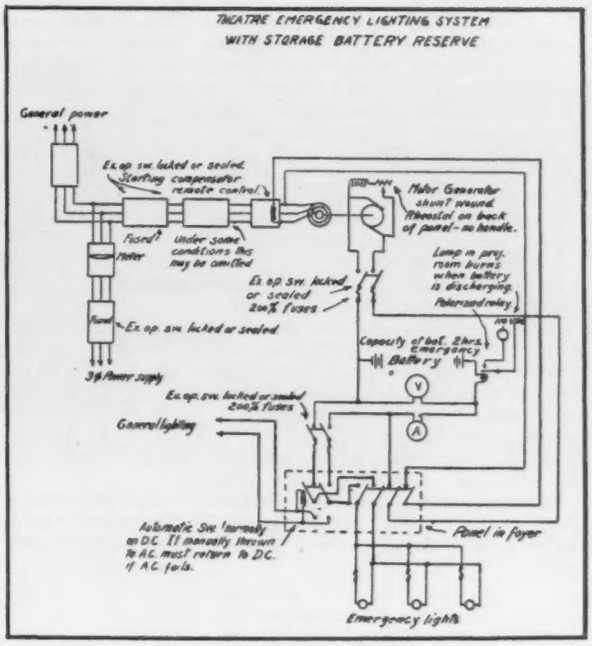

THEATRE EMERGENCY LIGHTING SYSTEM
WITH STORAGE BATTERY RESERVE
General power
Ex. op. sw. locked or sealed
Starting compensator remote control
Motor Generator shunt wound
Rheostat on back of panel—no handle.
Fused
Meter
Under some conditions this may be omitted
Lamp in proj. room burns when battery is discharging.
Polarized relay
Ex. op. sw. locked or sealed 200% fuses
Capacity of bat. 2 hrs. Emergency Battery
3ϕ Power supply
General lighting
Automatic Sw. normally on D.C. If manually thrown to A.C. must return to D.C. if A.C. fails.
Panel in foyer
Emergency lights

Fig. 2.

other words, a theater of 5,000 capacity should be regulated by the same **principles** as is one of 500, the **degree** of precaution changing. This basic idea is recognized by all who have been connected in any way with the construction of theaters and who realize the urgent necessity of quickly emptying them.

In this new code, therefore, there are four recognized means for obtaining service for emergency lighting. Commercial gas, pressure gas and other gas systems are not recognized. There are hazards inherent in the use of gas such that no gas pipe should be allowed in the building. In spite of the unfortunate history of gas in theaters, there is still a large city in California that requires gas for emergency lighting. This should not be.

In theaters seating 300 or less there are permitted three additional sources for emergency lighting besides the four that may be installed in the larger buildings. These are not as reliable as the first four but are thought to be satisfactory for small houses.

Storage Battery System Preferred

Listed among the first four as one of the reliable sources for emergency lighting in the storage battery system. Such a system is dependent upon closer maintenance than the three others. If, however, it is installed in either of the two methods, the wiring diagrams shown in Figs. 1 and 2, the board feels that during the life of the battery only the minimum of such maintenance will be required.

A number of installations using the circuits as shown in Figs. 1 and 2 are illustrated in connection with this article as they are examples of the latest development in the art.

Emergency lighting systems are valueless unless they are operating at the time an emergency exists. Furthermore, there should be enough light at all times so that patrons can see to leave the house without stumbling. This would require a minimum of one-fourth foot-candle of illumination throughout the parts of the building where patrons are allowed. There has been much discussion as to the amount of light which should be considered as desirable for a minimum. Some have held that one foot-candle should be required, others more and some less, but it seems to those who have tested the matter in actual installations, that whereas one-fourth foot-candle is a very small quantity, yet it should work out as a minimum but should be increased wherever convenient.

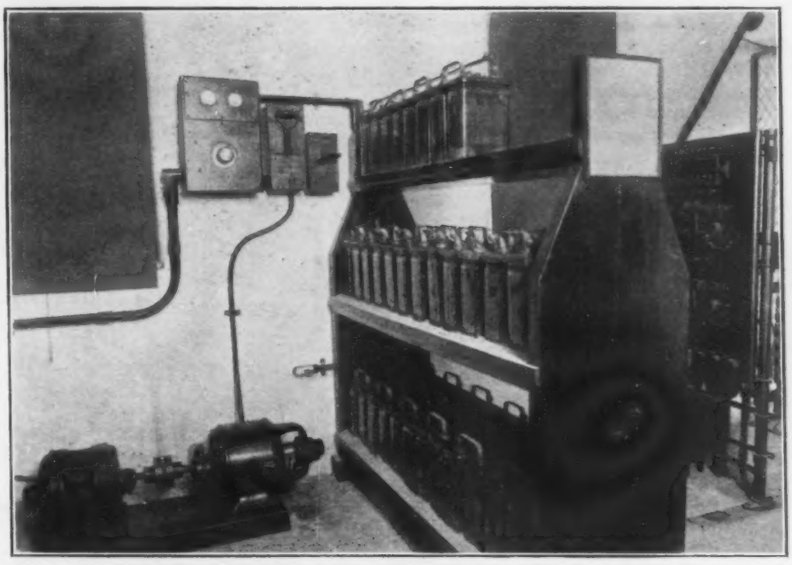
Seat number lighting, aisle lighting, other lighting of a similar nature, and the ventilating fan in the projection room should be maintained as on an emergency basis and therefore are permitted upon the emergency lighting system.

With the exception of aisle and seat-number lighting, all light outlets upon the emergency system should be controlled by a master switch **only.**

Then, with only one set of fuses in the feeder and one in each branch circuit, the chances for a dead or inoperative circuit are materially reduced.

Green Exit Lights

There is one standard, established by



Emergency lighting is as important to a hospital as to a theater. Emergency equipment for a San Diego hospital, including motor generator set, battery, and automatic cut-over contactors and relay equipment on board at rear.

the American Engineering Standards Committee years ago, that has not been generally adopted on the West Coast, probably because it has not been brought to the attention of the public. This standard is the use of the **green exit** sign with 5-in. letters. Red having been adopted as signifying danger and green as a safety signal, it was considered that the exits were a means towards safety and accordingly should have the green light.

If so much depends upon the public seeing how to leave a theater in case of emergency, it is reasonable to expect that exit lights should require two sources of illumination. For years manufacturers have complied with this requirement by putting two sockets for lamps into the boxes that hold the letters "EXIT." In spite of this provision the electrical contractor very often fails to supply the two sets of wires, one from the general lighting circuits and one from the emergency lighting system.

For years there has been no change in the rules for wiring the stage. The regulations of 1912 were basic in character and they hold to the present time. However, as the projection room is a product of the last ten or fifteen years, it was necessary to develop principles that would govern the new conditions and at the same time agree with the standards already evolved.

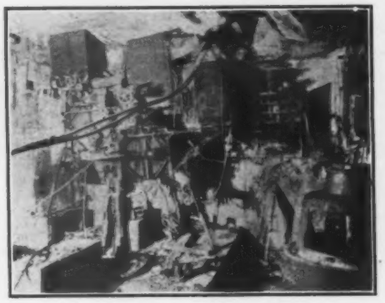
It is interesting to see that all additional rules needed to cover the wiring of a projection room have been embodied in nine or ten short paragraphs, of which only one touches on the size of wire. There seems to be no settled policy with theater owners as to what size and type of projection machine is to be used. Some machines are rated at 20 amp., others as high as 70 amp. The electrical subcontractor has no way of knowing what will be the size of machine installed. For this reason No. 4 A.W.G. wire is to be run to each projection outlet.

This must not be misunderstood: there are also rules governing the methods to be employed in installing the motor generator sets, resistance devices, panleboards, etc., but the **additional** wiring rules are few.

Film Handling Emphasized

Less than one page can cover all that is necessary to govern the handling, use and storage of films; but the hazard due to the use of the high explosive, nitro-cellulose, as a medium for carrying the picture, is so great that it was considered advisable to print two of the seven short paragraphs of that page in black-face type, with the caution that they **"be followed in extreme detail."** At no time should more than 2 ft. of film be exposed; no examination or repair should be allowed while a picture is being shown; and all rewinding should be done in a machine that totally encloses all portions of the film. To allow pieces of film to be left exposed outside of self-closing cans during repair or under any other circumstances should, by statute, be made criminal.

Film will burn in a bucket of water, carbon tetra-chloride (pyrene), foamite, or any other fire extinguishing agency which is at ambient temperature.



Havoc wrought in a projection booth by a film fire.

In most cases of film fires in projection rooms, the heat is so intense that the walls, if they are of sheet metal, will buckle and distort. An ordinary reel ready for the projection machine has approximately 2,000 ft. of film on it and frequently six to a dozen reels of film will be stored in the projection room.

Since the hazard is so exceedingly great, owners, contractors and city and state officials have co-operated in producing the rules governing the construction of the projection room and the manner of hanging the automatic shutters. A modern theater built to comply with these regulations may lose the entire equipment in a projection room with little danger to those in the audience.

Chemists have produced, and photographic film companies sell for home use, a cellulose-acetate film. This is a slow-burning film adaptable for use in a home although it seems a little dense for pictures where the screen is 100 ft. from the machine. Reasonable precaution taken with this film eliminates practically all hazard in conection with the use of "miniature" film in the home.

Useful Combination Table

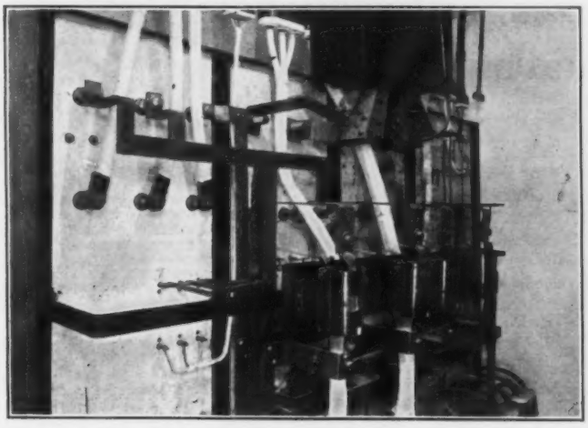
A handy table combining information usually found in widely separated portions of the National Electrical Code recently has been worked out by the data committee of the Estimating Section of the Northern Division, California Electragists, San Francisco. The table combines the allowable carrying capacities of wires with the number of wires permitted in one conduit and the minimum sizes of conduit in inches. The electrical contractor or estimator will find it a handy table to clip out and keep in his notebook.

ALLOWABLE CARRYING CAPACITIES OF WIRES					NUMBER OF WIRES IN ONE CONDUIT								
BS Gauge	Area in Circular Mils	Carrying Capacity—Amperes			1	2	3	4	5	6	7	8	9
		A Rubber	B Varnish Cloth	C Other Insulation	MINIMUM SIZE OF CONDUIT IN INCHES								
18	1624	3		5									
16	2583	6		10									
14	4107	15	18	20	½	½	½	¾	¾	1	1	1	1
12	6530	20	25	25	½	½	¾	¾	¾	1	1	1	1¼
10	10380	25	30	30	½	¾	¾	1	1	1	1¼	1¼	1¼
8	16510	35	40	50	½	¾	1	1	1	1¼	1¼	1¼	1¼
6	26250	50	60	70	½	1	1¼	1¼	1½	1½	2	2	2
5	33100	55	65	80	¾	1¼	1¼	1¼	1½	2	2	2	2
4	41740	70	85	90	¾	1¼	1¼	1½	2	2	2	2	2½
3	52630	80	95	100	¾	1¼	1¼	1½	2	2	2	2½	2½
2	66370	90	110	125	¾	1¼	1½	1½	2	2	2½	2½	2½
1	83690	100	120	150	¾	1½	1½	2	2½	2½	2½	3	3
0	105500	125	150	200	1	1½	2	2	2½	2½	3	3	3
00	133100	150	180	225	1	2	2	2½	2½	3	3	3	3½
000	167800	175	210	275	1	2	2	2½	3	3	3	3½	3½
	200000	200	240	300	1¼	2	2½	2½	3	3	3½	3½	4
0000	211600	225	270	325	1¼	2	2½	2½	3	3	3½	3½	4
	225000	225	270	325	1¼	2½	2½	3	3	3½			
	250000	250	300	350	1¼	2½	2½	3	3	3½			
	300000	275	330	400	1¼	2½	3	3	3½	3½			
	350000	300	360	450	1¼	2½	3	3½	3½	4			
	400000	325	390	500	1¼	3	3	3½	4	4			
	450000	362	435	550	1½	3	3	3½	4	4½			
	500000	400	480	600	1½	3	3	3½	4	4½			
	550000	425	510	640	1½	3	3½	4	4½	5			
	600000	450	540	680	2	3	3½	4	4½	5			
	650000	475	570	720	2	3½	3½	4					
	700000	500	600	760	2	3½	3½	4½					
	750000	525	630	800	2	3½	3½	4½					
	800000	550	660	840	2	3½	4	4½					
	850000	575	690	880	2	3½	4	4½					
	900000	600	720	920	2	3½	4	4½					
	950000	625	750	960	2	4	4	5					
	1000000	650	780	1000	2	4	4	5					
	1100000	690	830	1080	2½	4	4½	6					
	1200000	730	880	1150	2½	4½	4½	6					
	1250000	750	900	1185	2½	4½	4½	6					
	1300000	770	920	1220	2½	4½	5	6					
	1400000	810	970	1290	2½	4½	5	6					
	1500000	850	1020	1360	2½	4½	5	6					
	1600000	890	1070	1430	2½	5	5	6					
	1700000	930	1120	1490	3	5	5	6					
	1750000	950	1140	1520	3	5	5	6					
	1800000	970	1160	1550	3	5	6	6					
	1900000	1010	1210	1610	3	5	6						
	2000000	1050	1260	1670	3	5	6						

If single braid solid wires only, are used, then following sizes are permissible:

Gauge	Number of Wires	½"	¾"
14	4	7	
12	3	6	
10		4	
8		3	

Bus Bar Service to Switchboard

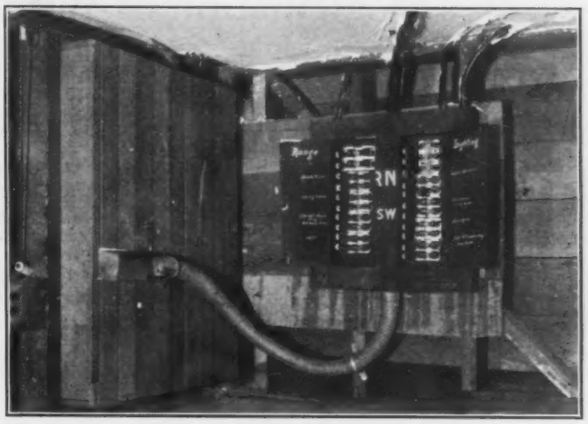


Instead of using conduit and cable for service a Frank Adam switchboard installed in the Radin and Kamp Building in Fresno makes use of copper bus bars instead. The copper service bars are placed in a duct of iron 21½ x 10½ in. inside dimensions. The buses are mounted on slate separators spaced every 4 ft. There are six 3¼-in. copper bars used, three for power service and three for lighting. These extend from the main switchboard in the basement to the second-story level on the building outside.

The advantages of this type of service are that it is more accessible, is easier to put in and makes a better looking installation. It is also a more economical job than pipe and wire for the same carrying capacity. This type of installation otherwise would have made necessary the installation of two 4-in. conduits, each carrying three 1,000,000-circ.mil. cables.

The installation was made by the Electric Construction Company, L. G. Jeffrey, proprietor, of Fresno.

Fuse Blocks Save on Switches



Fuse blocks were made to eliminate the necessity of installing individual externally-operated switches for each range and heater circuit in an electric home completed recently in San Francisco. The electrical contractor was F. H. Tattenham. San Francisco regulations called for individual switches for each such circuit. All heating and range circuits were made from this distribution center located in the basement. Fuse blocks were installed in an iron can to make up this distribution cabinet.

The lighting distribution cabinet is installed in a closet on the main floor of the house. This prevents the necessity of someone going outside the house in case a fuse should blow out and makes for a central location.

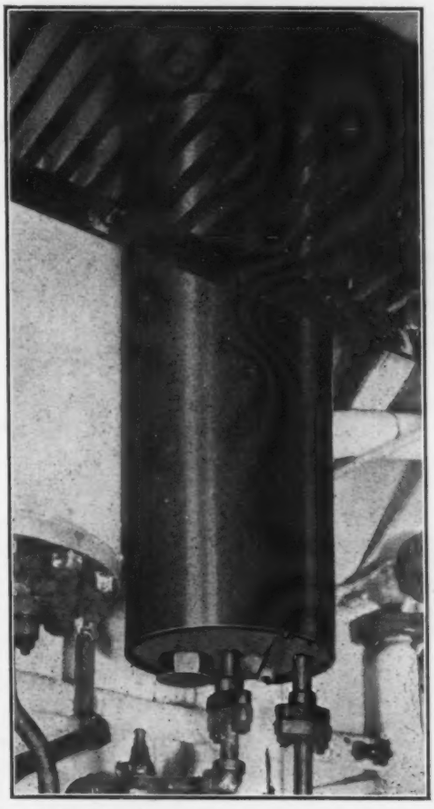
It will be interesting to note from the photograph that the basement ceiling was plastered in order to retain the heat in the rooms upstairs. All hot-water pipes throughout the house were lagged in 1-in. air-cell covering. The entire installation was made in conduit.

Oil Heater Devised Using Strip Heaters

A recent installation of an electric fuel oil heater on one of the ferries of the Key System in Oakland, made by the Pacific Electric Motor Company, contractors of that city, illustrates the possibilities for adapting strip heating elements to unusual uses.

In this case a method of raising the temperature of fuel oil from approximately 60 deg. to 250 deg. F. at the rate of five pounds per minute was required. Among the conditions to be met was the fact that the standard immersion type of heater is not available for 550-volt service, and that consideration had to be given to the effect of the moisture in the oil, the destructive compounds which are detrimental to immersion type resistors and the salt air.

The design as worked out was a spiral coil of steel tubing, carrying the oil under heavy pressure, the tubing to be surrounded by a heat insulating housing of steel filled with Sil-o-cell. Standard 110-volt G.E. air heaters of the strip form were used, arranged in three banks of 5 strips in series for a capacity of 7½ kw. at 550 volts. They were placed on an insulating spider of transite to insulate them from one another and ground, mounted in turn to the spiral of tubing, and were supported on the return tube passing through the direct center of the spiral. A standard immersion thermostat was immersed in the discharge end of the spiral at the top of the connection manifold. This thermostat was set for 250 deg. F. and functioned as a primary control switch through a flip flop relay. The switch was a standard G.E. 7,005 with the finger contacts connected in series for the 550-volt circuit operation. The control circuit was separated and operated on 110 volts alternating current so as to eliminate the danger of groundng on the 550-volt d.c. circuit.



Fuel oil heater on Key System ferry using electric strip heaters.

Reports from the Key System indicate that the operation of the heater to date has been highly satisfactory.

What Selling Will Do

As an indication of the possibility for increasing wiring installations by the use of a little sales effort the following figures from the Electrical League of Colorado show what one representative of that organization in one week has done. The statement speaks for itself:

Five residences, two stores and windows and one apartment house are more complete electrically because of Munchow's advisory service to builders and owners.

Last week's check shows that the following actual additions were made:

Convenience outlets	74
Ceiling outlets	4
Switch outlets (incl. 3-ways)	26
Bracket outlets	20
Telephone outlets	2
Reflector outlets	14
Special outlets	2
Total additions	142

Last week there were 71 extra outlets recommended and accepted for installation in eight jobs under construction.

Calculation of Wire Sizes for Frequency-Changer Installations

By H. L. GERBER, Department of Electricity, San Francisco.

THE DIRECT application of high-speed induction motors marks a decisive step in machine construction. Moreover, it calls for an almost complete change in that portion of the wiring installation which heretofore was absolutely necessary for the different classes of control of high and low-speed motors in the various branches of millwork.

The use of the high-speed induction motor has been rendered feasible by the development of the induction-frequency changer, which will generate power at frequencies producing motor speeds from 3,600 to 25,000 r.p.m., depending upon design.

The motors usually are built in as part of the machine, thus eliminating all waste energy which would be used for mechanical drive.

The motors used in conjunction with frequency-changers are designed as three-phase, two-pole machines. As the speed of a motor is directly proportional to the frequency of the supply circuit, any change in the frequency causes a corresponding change in the speed of the motor, i.e.:

$$\text{R.p.m.} = \frac{\text{Frequency} \times 60}{\text{Number of pairs of poles.}}$$

Then the speed of a two-pole motor is equal to the frequency × 60.

A frequency of 60 cycles = 60 × 60 or 3,600 r.p.m.

A frequency of 80 cycles = 80 × 60 or 4,800 r.p.m.

A frequency of 100 cycles = 100 × 60 or 6,000 r.p.m.

A frequency of 120 cycles = 120 × 60 or 7,200 r.p.m.

If the desired speed of the motor is divided by 60 the required frequency of the circuit will be obtained.

The motors are given a basic name-plate rating. Those used for millwork on matcher installations are generally rated at 220 volts and 60 cycles. These motors will operate on any other frequency and voltage within a definite limit, provided the other frequency and voltage is in direct proportion to the basic frequency and voltage of the machine: i.e., a motor designed with a basic rating of 220 volts, 60 cycles, 3,600 r.p.m., will operate at 187.5 volts, 100 cycles, 6,000 r.p.m. or 440 volts, 120 cycles, 7,200 r.p.m.

A frequency-changer is similar to a motor-driven generator set. The primary of the frequency-changer requires electrical excitation. The stator winding is the field, which is excited from an a.c. polyphase source of supply. The excitation may be either two or three-phase, and in either case produces a rotating field similar to that of an induction motor. The rotating field will generate current in the rotor, and if the rotor is stationary, the generated current has a frequency of 60 cycles. The stator and rotor then really act as the primary and secondary windings of a transformer. Now the rotor is driven by the drive motor. If the rotation of the rotor is in opposition to the rotating field, and reaches the same speed as the rotating field, the frequency in the rotor is twice the frequency of the field. Various frequencies are then obtained by changing the speed and direction of the rotor.

After an extensive amount of testing and study of the characteristics of drive motors, frequency changers, machine motors, etc., the following rules were compiled to meet general field conditions. The wiring for frequency-changers as recommended by the factory does not always conform to the requirements of the electrical rules and ordinance of that state or locality in which the installation is made. Again, a frequency-changer set designed for a given machine, may be installed. At some later date the mill owner decides that an additional matcher is to be installed. Not wishing to be burdened by the additional expense in the purchase of a new frequency-changer set the second matcher is connected to that frequency-changer which was originally designed for the one machine. These and similar conditions were the instigation of serious discussion on the subject of diversity factor in both machine and wire sizes for such installations.

With some installations supplied by a 440-volt three-phase source of supply it was found necessary at certain times to run the matcher motors at a speed which could be obtained only by a supply voltage of 220 and a frequency of 60 cycles. Such a condition is met by tapping the winding of the drive motor stator and transferring the matcher motor feeder from the frequency-changer secondary to the tapped stator coils, allowing the stator coil to function as an auto-transformer to supply the necessary 220 volts 60 cycles.

In order to cope with these and similar conditions, and have the installation meet with state laws and supply a reasonable safety factor, the following rules were compiled and approved by the Department of Electricity of the City of San Francisco:

Rules

1. The total connected name-plate horsepower of matcher or moulder motors shall be used as a basis for computing the wire sizes for the complete frequency-changer installation.

2. The primary of the frequency-changer shall be wired for 125 per cent of the total connected horsepower, decreased by the ratio of the primary frequency, divided by the secondary frequency. Current and wire sizes then will be computed from the state tables for general purpose motors: i.e., assume the total connected horsepower is 45, primary frequency = 60 cycles, secondary frequency = 100 cycles. Then

$$\frac{45 \text{ hp.} \times 1.25 \times 60 \text{ cycles}}{100 \text{ cycles}} = 33.8 \text{ hp.}$$

Consulting the motor tables* for voltage rating of the frequency-changer it will be found that for 33.8 or 35 hp. motor, 440 volts, three No. 4 wires are necessary.

3. The drive motor for the frequency-changer shall be wired for the total connected horsepower decreased by the ratio of the secondary frequency, minus the primary frequency, divided by the secondary frequency. Current and wire sizes shall be computed from state tables for general purpose motors: i.e.; total connected horsepower = 45; primary frequency, 60 cycles; secondary frequency, 100 cycles.

$$\frac{\text{Then } 45 \text{ hp.} \times (100 - 60)}{100} = 18 \text{ hp.}$$

Consulting the state tables for general purpose motors it will be found for the voltage rating of drive motor, say of 440 volts, and 18 or 20 hp., that three No. 6 wires are necessary.

If a special drive motor with tapped stator is used for reduced voltage and speed conditions, the wiring to the drive motor shall not be less than 35 per cent of total horsepower.

4. To compute the wire sizes for the feeder for both the drive motor and frequency-changer, proceed as follows:

As figured in paragraph 2, the primary of the frequency-changer is wired for 33.8 hp.; as figured in paragraph 3, the drive motor circuit is wired for 18 hp.; taking the summation of both horsepowers, we have 51.8 hp. Consulting motor tables for primary voltage of the frequency set and 51.8 or 55 hp. it will be found that three No. 2 wires are necessary.

Wiring from the frequency-changer secondary to the matcher motors shall not be less than 65 per cent of the combined current ratings of motors.

The primary of the frequency-changer and motor stator may be connected to the same feed wires, provided that a contactor switch is installed ahead of the primary taps to the frequency-changer, said contactor to contain overload relays or similar running fuse protection. The magnetic coil of the contactor shall be connected to the running side of the compensator of the drive motors.

All control circuits shall be protected by fuses.

All individual motor circuits shall be wired for full connected horsepower.

* Electrical safety orders of the Industrial Accident Commission of the State of California.

Question Box

Q. What is a "crest" voltmeter?—S.R.G.

A. A milliammeter calibrated to read directly by means of rectified charging current the "wave peak" or crest of an alternating voltage. It is usually operated in connection with a condenser type bushing of a testing transformer.

Q. Can you give me a formula for a hard solder—T.H.C.

A. Copper 1 lb.; zinc, 8 oz.

Q. What is the safe load, in pounds per ft. for an "I" beam 24″ depth, wt. 95 lb. per ft., 10 ft. span?—B.S.L.

A. 20,520 lb. per ft.

Q. What is the bearing power of hard rock—B.P.S.

A. 25 to 30 tons per sq.ft.

Q. Can you give me the name of some timber having a strength of about 5,000 lb. per sq.in.?—J.T.F.

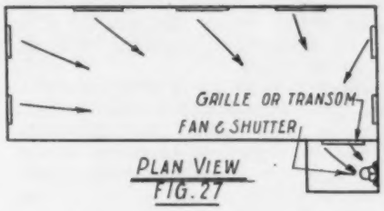
A. Chestnut, 5,100 lb.; Washington cedar, 5,100 lb.; Idaho cedar, 5,100 lb.

Special Applications of Electrical Ventilating

Basments and Anterooms Often Require Special Treatment in the Placing of Fans and Duct Systems

By J. R. WILSON*, Quality Electric Works, Los Angeles.

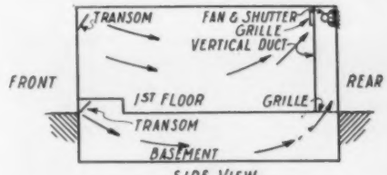
IT IS sometimes necessary or desirable to ventilate one room by placing the fan in an adjoining room: Fig. 27 shows such a case where a room is being ventilated through an adjoining toilet or ante-room. It will be noted that the incoming air enters through



PLAN VIEW
FIG. 27

the windows or other openings in the larger room. By means of a grille placed in the adjoining wall of the smaller room the foul air is carried to the outside of the building by the suction of the fan. The proper location and size of the grille is the secret of success in this case.

It is of the utmost importance that the grille in the wall have a free area equal to that of the fan. If the fan is 24 in. in diameter it will have a total area of 452 sq.in., and the grille should have an equal amount of free area. In figuring the free area it will be necessary to take account of the previously mentioned fact that the average grille offers 50 per cent restriction to the passage of air through it. Hence, we must double the size of the grille: $2 \times 452 = 904$ sq.in. This would square to about 30 in. x



SIDE VIEW
FIG.-28

30 in. in size, which is a standard size for a grille or register face. Automatic louvers always should be used on the outside of the fan, to preclude all possibility of the entrance of wind, rain and snow. The system shown in Fig. 27 should be recommended always where extreme quietness of operation is desired. It has this advantage also —that the fan is out of sight, doing away with all unsightliness.

It is very desirable sometimes to ventilate the basement as well as the first floor. Fig 28 shows a method whereby this can be accomplished by means of a fan, or fans, placed on the first floor. As will be noted, a vertical duct is installed from the first floor location of the fan to a point at the basement ceiling line. This duct has a grille placed in the bottom, also a grille placed opposite the fan near the first floor ceiling. These grilles should be divided in size so that their total free area equals the area of the fan, and provides the circulation desired on each floor.

Where it is desired to ventilate a basement only, resort may be had to a transom placed in the front bulkhead, with the fan placed in the rear wall. Where the basement ceiling line is below the ground level, special means must be provided to permit the fan to exhaust to the outer air. This may be done by means of a heavy galvanized duct and elbow, or as shown in Fig. 29. The ventilation of basements is of great moment where there is a tendency to dampness. The use of ventilating fans will remove completely all danger of mildew, rusting, warping of wood work, etc. Basement stock rooms, pool rooms, bowling alleys and stores offer a fertile field for the installation of ventilating equipment.

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Electrical Estimating Series—XXXIV

Sloppy Wiring

Whether it is because of poor mechanics or because the work is taken at a very low figure or what, there is too much sloppy wiring being done in residences. It certainly is not good advertising for a contractor to have the switch plates in a house at all angles, to have the wiring in the basement hanging in festoons or to have the fixtures hanging on a drunken angle.

It probably does take a few minutes longer to do each thing in a workmanlike manner, but it is doubtful if the contractors who do, or permit their men to do, that class of work are so efficient as to utilize every moment so saved.

This is not something that can be regulated by code, for it in no way affects the quality of service or the safety of the wiring. The only law that has any control over such work is that of pride. If a man has the ability to feel the pride of achievement, the pride of doing a good job, he will not allow sloppy work on his contracts. It takes a real "he-man," however, to have that pride. If a man is inclined to do as little as possible, to cheat, to "get away with things," in other words to have a selfish and small personality, there is no way to get him to do a workmanlike job.

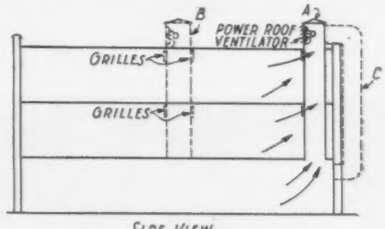
—Denver Electrical Contractors Association Bulletin.

In a building containing several floors it is possible to ventilate each of the floors by means of one power roof ventilator. Various methods of handling this situation are available—depending upon the building construction, location of windows, etc. In Fig. 30 three methods are illustrated. In the first method the ventilator is placed at

SIDE VIEW
FIG.-29

"A" at the rear of the building. A duct is installed from the fan pent house through each floor to the lower floor. A grille of proper size to give the desired circulation is installed in this duct at each floor. In this system all of the rear windows on the various floors are kept closed and the circulation is from front to rear.

At "B" is shown another method wherein it is desired to have both the front and rear windows open. A duct is installed near the center of the room with one or more grilles placed at each floor. Either of the systems shown at "A" or "B" will work perfectly if properly designed and is highly recommended for stores, office buildings, factories or other multi-story buildings. If these ducts are installed



SIDE VIEW
FIG. 30

when the building is being erected a very sightly installation can be designed.

The third method, shown at "C," is commonly used where it is objectionable to place the duct on the inside of the building. Here the duct is placed on the outside of the building with the power ventilator placed at the previously noted location "A." Where this method is used either the rear windows or grilles may be used to provide the necessary openings into the duct. In any of the systems noted satisfactory results will be assured if fans of adequate size are used and the sizes of ducts and openings are carefully planned.

(To be continued.)

Better Merchandising

Percolator Sales Can Be Perked Up

The Old Coffee Pot Still Bubbles in Households Where the Idea of Electric Coffee Has Not Yet Percolated—and Why?

APRIL may be a month of Easter eggs to the big butter and egg men but it is a month of percolators to the electrical industry. Just what the cold storage egg trust did to get public acceptance to the point of a national holiday is not known. What is known is that the electrical industry wants to get on the same breakfast table with the matutinal egg a shining electric percolator which knows how to make coffee-as-it-should-be-percolated.

The old adage, "If wishes made Easter eggs the bunnies would hide," applies in this case. Wishes will not put percolators on the breakfast table. Those who wished hard enough for percolators have all bought one by now. The others must be sold.

Children may hunt laboriously for Easter eggs but grown-ups will not hunt percolators in electrical stores which hide these appliances somewhere among the stock. The first thing that must be done to get the percolator sales perking is to display percolators—prominently.

One ingenious salesman of percolators even went so far as to create a yearning for percolators by using a fan to sweep coffee fumes out in front of his store from coffee that was roasting in his basement under the sidewalk. In the window sat a percolator, with coffee in it, percolating itself luxuriously. A neat card tempted with still another medium of temptation besides the smell of coffee, the sight of coffee percolating—it clinched the argument by saying:

"There's a good cup of coffee for you just inside the door—electrically percolated coffee. Come and get it." No further inducement was needed to bring prospects into the store.

95¢ down
Balance $2 a month
Total Price $8.95
quality
means much.
quality coffee is assured with this quality electric percolator.
enduring quality is built into this percolator—the purchase of which will be pleasantly recalled thousands of mornings over your cup of coffee.
$1.00 allowance for your old coffee pot.
MOUNTAIN STATES POWER COMPANY
BUY AN Electric Coffee Percolator

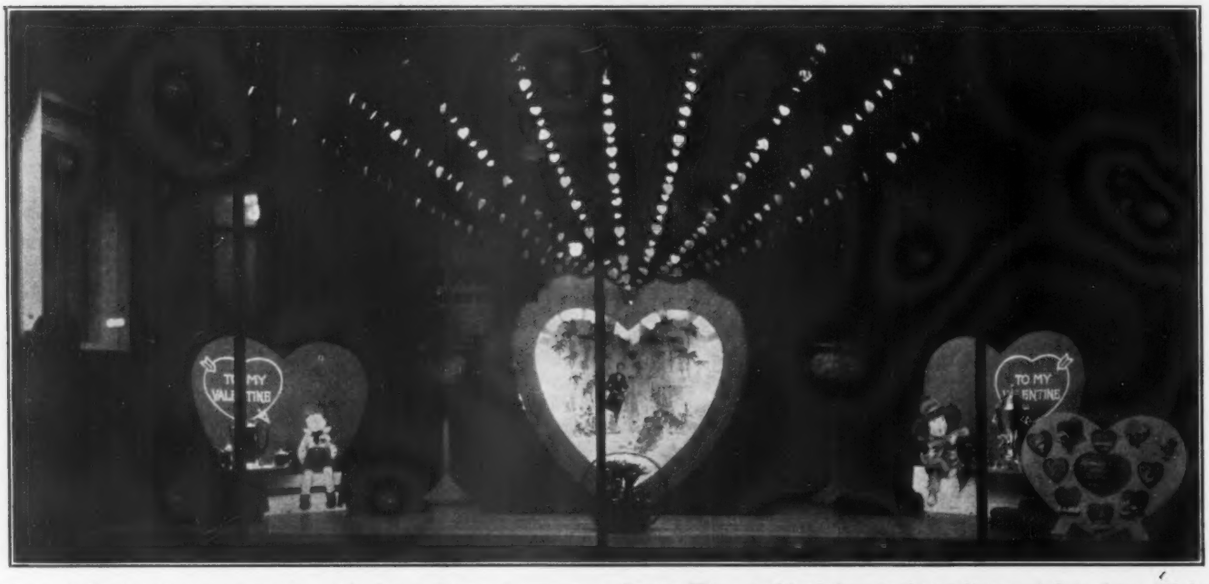
In the great Northwest these little daily advertisements sank many a coffee pot.

Whatever method is used to stimulate sales should be followed through. If it is advertising, then the store should be organized to climb aboard that advertising and ride it to a sale. Nothing kills a special sale as do the details left uncompleted.

To cash in on the national advertising being done on percolators, on the advertising being done by power companies, leagues or even other merchants, the store must be organized to show percolators, center attention on percolators, demonstrate percolators—and the product of their good works upon good coffee is the best evidence there is—and sell percolators.

When a man goes into a drug store to buy razor blades he is lucky to get away without buying soap, face lotion, a new razor and a package of cigarettes. If a customer comes to buy lamps why should she not leave the store with a taste of good coffee on her tongue and a percolator under her arm?—as well as the lamps, of course.

Romance and Business—and the Happy Medium



James A. Meek, sales manager, Mountain States Power Company, at Casper, Wyo., combined them in the appliance window above. "Make her happy with an electrical valentine" the large heart at the right urged, and small hearts displayed appliances to give.

Declare Premiums Necessary to Attract Business

One of the great values of conducting a business on a budget basis is the fact that both before and after the year's work, a digest of the situation may be had. The year 1927 was actively scheduled by the sales department of the Public Service Company of Colorado under the leadership of G. B. Buck, general commercial manager. Throughout the year campaigns were scheduled at regular intervals. The details of each campaign were worked out to schedule the work for the entire personnel of salesmen. An allowance of 2 per cent of gross sales was allowed for advertising. The gross amount of merchandising business done in 1927 amounted to $1,750,000.

A coincidence unique in this organization is that the birthday of the vice-president and general manager, Clare N. Stannard, and the Public Service Company of Colorado is one and the same day, which fact gave inspiration for an anniversary sale. This was on Nov. 13 and the advertising and general set-up was conducted so that the Christmas sales might also benefit. For the anniversary sale a full page newspaper advertisement, bearing pictures and descriptions of all the merchandise for sale by this company was offered for one day only with a 10 per cent "anniversary discount." All appliances carried a special red tag with the reduced price plainly marked, in addition to the regular priced green tag, and the surprising result was that the sales for this day were the largest one-day's business in the history of the new business department.

Special Offers Made

Then came the approaching holidays, the time when business is expected by the electrical retailer with the expenditure of but little or no effort. So complacent an idea for letting sales come as they might was discarded and a carefully budgeted plan adopted which included the advertising of appliances through the medium of broadsides as well as that of newspapers. The newspaper advertising showed a picture of all the appliances attractively arranged, each with a few lines of description and the price.

On Friday, Dec. 24, all papers carried a special announcement for the one more shopping day and made the added offer of a ride home in a taxi with every purchase of $35 or more, or a coupon given free with every purchase of $5 entitling the purchaser to a photograph of any member of the family. With each purchase of one of the electric irons, a minature 2½-lb. boudoir iron was given away. With one of the makes of waffle irons, one 8-piece waffle service of Limoges china was given.

The percolator stock ranged from $8.50 for a 4-piece set, to $100. Toasters, trays, and the like were carried in complete stock with every imamginable sort of variation and the analysis showed, after the holidays, that Christmas sales for 1927 hit a new high level with nearly all excessive stock, particularly toasters, percolators and small appliances, practically exhausted.

As a result it was found that during 1927 consistent sales results were very encouraging and the two sales, anniversary and Christmas, were particularly productive. It is felt by this company that proper stimulation and sales effort are required to bring home even the business that is more or less expected but at the same time needs the beacon light that steers the buyer to the door.

Illuminated Outlets on Red Seal Display

In furthering the promotion of the Red Seal plan, the illuminated wiring diagram of a model Red Seal Home shown in this display of the Southern California Edison Company was built by George M. Rankin of the California Electrical Bureau.

In this plan of the modern electrical home, miniature lamps of different colors are used to indicate different types of outlets. These lamps are operated on a six-volt transformer off the standard 110-volt service.

In the plan, white lamps indicate lighting outlets, amber lamps indicate switch outlets; red lamps, convenience outlets; green lights, range, water heater or bathroom heater; blue lamps indicate telephone connections.

The words "Electric Home" in the two 4-ft. Red Seal insignias are illuminated from the back, and small flashers lend animation to the entire display.

The Southern California Edison Company is sending the Red Seal window display from one district to another throughout its system.

Chamber of Commerce Boosts Better Store Lighting

Upon its own initiative the Chamber of Commerce of Burlingame, Calif., launched a campaign recently for better lighted stores in that community. The following newspaper article, published by the Burlingame Advance-Star tells the story:

Better Lighting of Stores Planned by the C. of C.

Adopting for its slogan "A Lighted Store Is a Live Store," the Burlingame Chamber of Commerce today inaugurated an intensive campaign for better illumination of the store windows on Burlingame Ave. and Broadway. At the same time the merchants' committee of the Chamber, of which John D. Bromfield is chairman, announced the completion of a thorough survey of the present lighting facilities in the various places of business.

Several months ago the committee secured the services of illumination engineers to study the local situation and make a report. The results of the survey were submitted yesterday to a meeting of the committee held in the Chamber of Commerce offices and attended by Blanche J. Shelton of the Merchants' Association, James Porter, George Warden, P. R. Rork, Chairman Bromfield, and Leonard Read, secretary of the Chamber.

The committee authorized Read to give to each merchant and business man a report on the present lighting of his place of business, with a request that he do everything possible to carry out the recommendations.

The thorough survey referred to was made by the lighting bureau of the San Jose division, Pacific Gas and Electric Company, which inspected 121 places of business, and found out where good illumination was needed in windows and store interiors.

Lighting of Portland Utilities Building Sets Example

Intensities Ranging from Twelve to Thirty Foot-Candles Made Possible by Spacing and Selection of Units for High Wattages

By Fred Zaugg, Illuminating Engineer, Northwestern Electric Company, Portland, Ore.

THE RECENTLY completed Public Service Building, Portland, now serves as the home of the Northwestern Electric Company, Portland Gas & Coke Company and Pacific Power & Light Company. In planning the lighting for the building an effort was made to make the installation in every respect strictly in accord with the best modern practice. All the general office space from the second floor to the top is provided with the Keldon semi-indirect lighting unit, which produces a soft, uniform illumination. Hanging heights were carefully watched. In all of the general offices, units were selected of such size as to produce an average permanent lighting intensity of 12 foot-candles and in the clerical working spaces, drafting rooms, or any place where close work is done, intensities varying from 14 to 30 foot-candles were installed. It has been found that these intensities are quite acceptable to the people working under them, and that the installation produced many favorable comments. The lamp load runs from 2½ to 6 watts per sq.ft.

The auditorium, on the third floor, has a seating capacity of 400 and is wired like a small theater. There are foot lights in three colors, border lights, projector outlets, heavy-duty plug outlets on the stage and back stage control of the general lighting, which makes it convenient and adaptable to demonstrations, stage performances, and all sorts of meetings. Keldon units also are used in the auditorium.

High Intensity on Sales Floor

The main sales floor, covering one-half block, of which one-half is used by the Portland Gas & Coke Company and the other half by the Northwestern Electric Company, is lighted by a total of 86 Ivanhoe Celestialite units. Celestialite is a color correcting glassware made up of three separate layers of glass. The outside is clear for mechanical strength, the next layer is opal for diffusion and the inner layer is blue for color absorption. The resulting light from these units approaches daylight in character and makes the interior lighting blend quite closely with the natural light coming through the large windows. In the center portion of the sales floor where the ceiling height extends to the second story, sixteen 26-in. single units are installed on 14 x 24-ft. centers, 16 ft. above the floor. These pieces of glass weigh approximately 35 lb. each and were made to order for this job. Each unit contains one 1,500-watt type "C" Mazda lamp. Under the mezzanine floor 18-in. units with 500-watt lamps are installed on 10 x 12-ft. centers, 12 ft. from the floor. There is an average lighting intensity of 22 foot-candles on the main floor at table height. The mezzanine floor, used as office space, is lighted with units of the same type for consistency of appearance from below. An average of 13 foot-candles is obtained here with 16-in. 300-watt units on 10-ft. centers. The general lighting fixtures were furnished by the Ivanhoe division of the Miller Company and the window lighting units by Frink Inc.

Windows Have Special Lighting

The window installation consists of a double bank of Frink, multi-light, trough units installed in an over-all sheet metal housing. There are two rows of 10 or 20 lamps arranged on four circuits in each 11½-ft. window. A fifth circuit is used in each window for Frink spot light lamps which are mounted on the over-all housing. The units are equipped with 150 and 200-watt type "C" lamps which makes it possible to obtain several different lighting intensities by simply operating switches. Color screens are provided for each unit allowing many color combinations. Each window has also been provided with two circuits for foot lights and two other circuits for convenience outlets.

The complete bank of units in each window is portably suspended, so it can be raised or lowered by a self-locking gear that is manually operated from the floor with an extension rod on a 7-in. sweep brace. These banks may be lowered to within 6 ft. of the floor for relamping or changing the color medium, or set at any height that might be desired for lighting special displays. There is an independent distributing cabinet conveniently placed for each two windows. Each circuit is on an independent switch and each cabinet is on a master switch, and in turning the complete window lighting on or off the master switches are used. This assures the same lighting effect for the duration of the window display. A portable flasher is arranged to be connected to any of the circuits at the cabinets so as to get moving color effects.

At the entrance to the sales floor, a specially designed electric fountain has been placed. The cast stone bowl, in the center, contains 12 150-watt lamps arranged on three circuits, the lamps being covered by a clear glass plate on which are laid sections of colored glass for different effects. Colored glass is also placed in front of four lamps in the pond in which the fountain stands. The circuits are carried to a flasher which keeps the colors continually changing. On a cast stone pedestal in the center of the tower is a 2-ft. clear glass bowl, through which the color effects are projected.

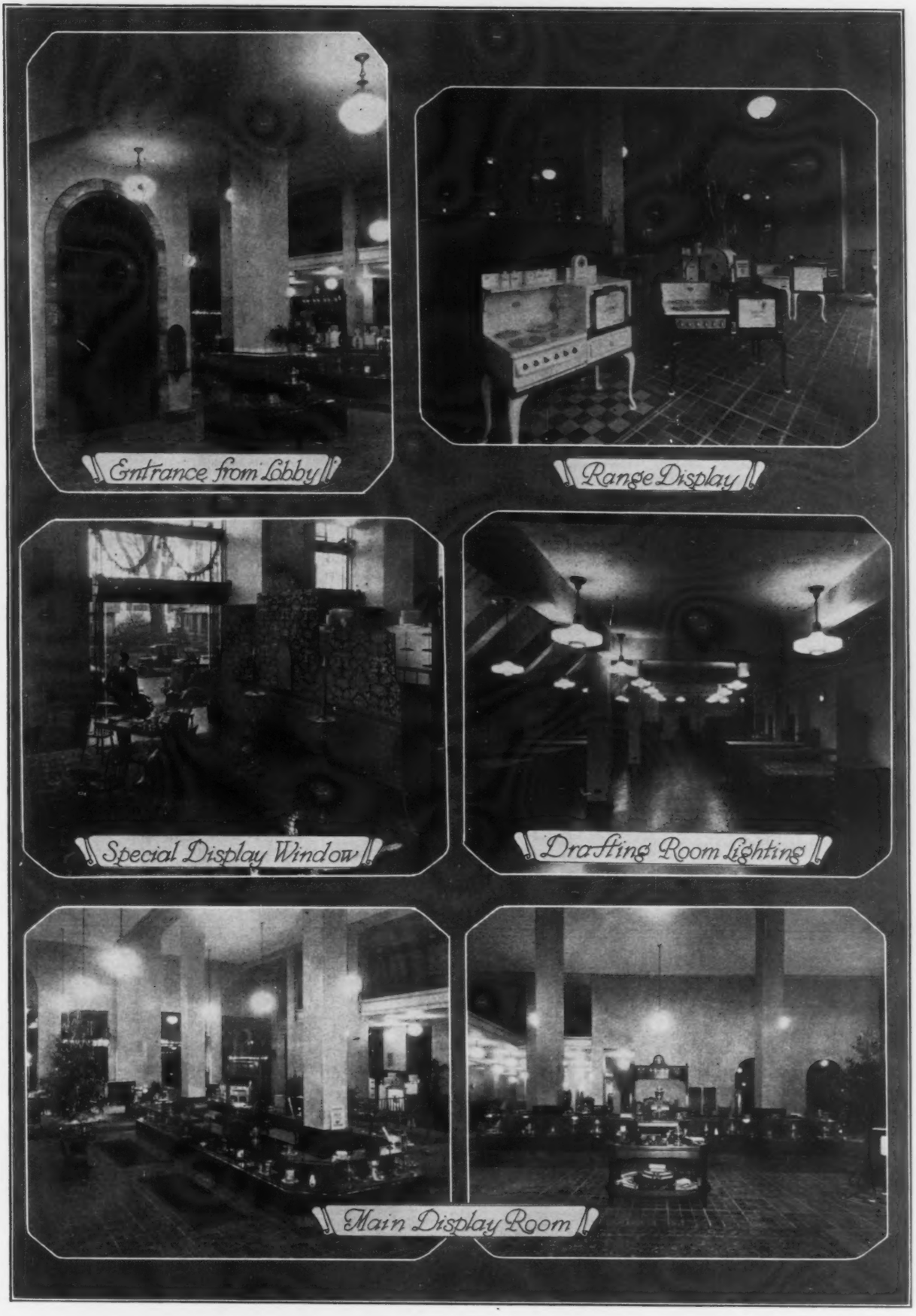
On the inner face of the rampart which is constructed around the building at the fifteenth floor level, there are mounted specially designed outdoor cove lighting strips containing 69 150-watt lamps per side, or a total of 276 lamps, making a connected load of 41.4 kw. The lamps are arranged on three control circuits, thus allowing from one to three colors being used at the same time, or several different intensities of any one color. The color effect is obtained by placing colored glass over the lamps in slots provided for this purpose. Trough lighting units were used here on account of the lighted surface being only 12 ft. high; the resulting light distribution is very even.

Exterior Flood Lighting and Neon Sign

On the thirteenth floor level there are cove lighting strips mounted in the loggia between the bases at the columns. This installation consists of 57 200-watt lamps per side or 228 on the four sides, making a connected load of 45.6 kw. As on the upper floor, these units are on three-control circuits for varying intensities and color effects. For convenience of control and simplicity of installation, all controls are located on the sixteenth floor. Cove lighting strips were specially made for the job by the Frink company.

Around the top of the building there is installed a four-sided Neon sign, the largest of its kind in the West and one of the largest in the world. The letters are 12½ ft. high, average 8 ft. wide, and have a face 21 in. wide. Each letter has a double row of Neon tubing. There is a total of 2,080 ft. of tubing in the sign and it has a connected load of 16 kw. The sign frame is 60 ft. on the side, the top of it being 220 ft. above the street.

Lighting Data Books—Two new lighting data books have been issued recently by the Edison Lamp Works of the General Electric Company and are available to dealers to use in furthering the sale of lamps and lighting equipment. The first and more generally useful is one entitled "Lighting . . . . . the Home." It takes up the subject of the flexibility of lighting and goes into the proper lighting for the various rooms of the home and grounds. A very good section on wiring suggestions ends the book. The second data book, entitled "The Mazda Lamp in Projection Service," takes up the technical questions of optics as connected with projection equipment and describes the Mazda lamps designed for that purpose and how they are to be used and adjusted. Considerable valuable technical data is included as to sizes of lamps, width of pictures, length of throw, reflecting values of various types of surfaces, etc.


Entrance from Lobby
Range Display
Special Display Window
Drafting Room Lighting
Main Display Room

Co-operating and "SWAP" Range Campaigns

Dealers and Central Station Add Load to Lines

A UNIQUE electric range sales campaign, having as its purpose the elimination of all ranges built prior to 1921, is the result of a plan which H. C. Rice, merchandising manager for the Southern California Edison Company, has worked out.

"The industry has long known," said Mr. Rice, "that one of the biggest obstacles to the sale of electric ranges is the presence throughout the country of these six or eight-year-old electric ranges with their relatively slow cooking speed and with their consequent increased operating cost. We have been up against practically the same proposition that the automobile manufacturer would have to meet if the bulk of the buyers of his product were to use the same automobile for seven or eight years.

"We have decided to take a leaf from the book of the automobile sales organizations and make a generous allowance to owners of these old ranges, on the purchase of new ones.

"To date, this swap campaign has proved to be very effective, 139 of these exchange sales having been made during the first month of the sale. Approximately 4,000 of these older type ranges now are being used on the Edison system and it is the company's intention to continue the sales exchange program until as many of these 4,000 ranges have been removed from the lines as posisble."

In furthering this campaign, the word of mouth method is used, no advertising of any kind being brought into play.

If present plans carry through, it is expected that this move on the part of the Edison company will have a very stimulating effect upon all range sales activities in the territory covered.

Co-operative Campaign

Ample evidence that it is possible for the electrical industry to co-operate wholeheartedly in a given task and to bring that task to a satisfactory completion is offered in the report of the recent Hotpoint range campaign, which was put on throughout the territory served by the Southern California Edison Company — the central station working in co-operation with the contractors and dealers on their lines, in a seven weeks' campaign, beginning Oct. 10 and ending on Nov. 25.

There were sold 1,331 ranges; of this number 1,003 were actually sold by the Southern California Edison Company; the remaining 328 were sold through contractors or dealers. The basic sales methods which had been well proved in the previous range campaigns put on by the Southern California Edison Company were followed for the most part.

The ranges were sold at list prices, a down payment of $10 on any model Hotpoint range being accepted; the balance was made payable in six, twelve or eighteen months. The installation cost was added to the cost of the range and the buyer therefore had but one bill to meet, and that on the easy terms outlined above.

An Edison waffle iron and tray were offered as a premium to each range buyer. During the period of the campaign this same waffle iron and tray set was used as a small appliance special, listed at a very special price of $8.50 for the campaign. This, in effect, established a definite value for the premium and created in the minds of the possible range buyers the impression that the premium was a very worth while consideration.

Salesmen were permitted to offer a trade-in allowance for any old cooking equipment which the range prospect owned. The price which could be offered for this old equipment was limited to not more than 10 per cent of the value of the new range to be bought. This proved to be a valuable inducement in producing sales, and the records made at the close of the campaign show that 484 sales had a trade-in allowance made on them.

Dealers throughout the territory were authorized by the Edison company to make the same offer to any of their prospects. While the Edison company made these offers applicable to Hotpoint ranges only, the dealers were permitted to offer a salvage allowance on any old cooking equipment for any make of ranges which they might be selling. In the matter of premiums, the dealers were authorized to offer the waffle iron to buyers of Hotpoint ranges only. The Edison company refunded to the dealer the amount of money which he paid out in the form of salvage value for the old equipment, and in addition to that the Edison company furnished the dealer with the premium, the Edison waffle iron, for each bona fide Hotpoint sale which was

Let this Hotpoint Automatic Electric Range do your Cooking
DISON COMPANY.
How Little down and How Little a month will I have to pay for the new, Rapid-Cooking Hotpoint Electric Range? Also, how will your special combination rate on electricity help me to buy my range?
Name
Address
Only $10 down places this wonderful Servant in your kitchen... ready to use!
The balance in small payments will be spread over six, twelve or eighteen months, as you wish... Your down payment covers everything. Simply select the model you want, from your nearest Edison office, or your own dealer. Pay as little as $10 down; that is all.
Buy Now and get this beautiful $8.50 Waffle Iron FREE
Complete the Modernization of your Kitchen with a Hotpoint Electric Water Heater
This waffle iron, with handsome two-tone nickel tray, is selling now at the very special price of $8.50. It will not cost you a single penny, if you order your range now.
For just a little more, you can have one of those splendid heaters installed at the same time your Hotpoint Electric Range is put in. Then have hot water in abundance, day or night, as you need it.
The Special Return Card will bring you Full Details
Mail the enclosed card today and learn for how little down, and how little a month, you can have these modern cooking helps. Ask, too, about our special rate to owners of Electric Ranges, which will help you buy your Hotpoint Range.
SOUTHERN CALIFORNIA EDISON COMPANY
or Your Dealer

One of the first three broadsides with postcard attached used in the campaign. It was circulated to a list of 40,000 names.

Below, the advertising used concurrently with the range campaign to sell waffle irons. One of these irons was given free with every range sale. This advertising also stimulated range sales.

For Making Dozens of Delicious Dishes
The EDISON Waffle Iron is a modern cooking aid of general utility... a handy means of cooking dozens of delicious dishes... right at the table, if you wish. On this page are just a few tested recipes; you will think of many other dainties, for the family, for parties, for after-the-theatre luncheons, which can be prepared on your Edison Electric Waffle Iron. October 10 to November 25, this splendid iron designed to our special standards, will be sold at the low price of $8.50
Free... this handsome Tray
The New EDISON ELECTRIC WAFFLE IRON
(Made by Hotpoint)
Complete with cord, plug and tray... all for Eight-fifty
SOUTHERN CALIFORNIA EDISON COMPANY or Your Own Dealer

Prove Profitable

in Joint Activity

At sales meetings held in the district offices, this display of interest creating material was used. The four cards occupying the center, spelling L-O-A-D, were used to emphasize the primary purpose of the sale.

made. This made it possible for the dealer to make the same offer to his customers that the Edison company was making.

Special emphasis was put upon the sale of water heaters during the campaign, with the result that 239 water heaters were sold by the company. Estimating each range at 10 hp. and each water heater at 5 hp., a total of 14,505 hp. of new load was added to the company's lines through this campaign.

Within the Edison merchandising organization every effort was made to bring up the selling urge to a high point. Substantial prizes, both merchandise and cash, were offered to the salesmen of the Edison company, and each of the 31 districts had a sales quota assigned to it. The first prize to the district manager of the district selling the largest percentage of its quota was a beautiful desk set. In computing these results both the company sales and dealers' sales were taken into account. In determining the distribution of the salesmen's prizes, just the Edison sales were counted, however. The first prize, a Radiola No. 20, for the salesman selling the highest percentage of his quota, was won by W. C. Clary, of the Redondo Beach district. The second and third prizes, consisting of chests of silver, were won respectively by P. C. Hargrave of Tulare and W. H. McGinnis of San Bernardino. In addition to these capital prizes, there were weekly cash prizes for the salesmen selling the largest percentage of their weekly quota. The weekly quota consisted of one-seventh of the total quota, except that in all cases a minimum of two sales per week was necessary to get a prize.

To carry the story of the campaign to the general public, three advertising media were used. Good selling type window trim was furnished each district office, together with suggestions for the actual handling of this material. Newspaper advertising on a large scale was used throughout the territory. The advertisements, of which there was at least one a week for every one of the 160 newspapers on the Edison company system, carried the name of the local dealer and contractor as well as the Edison company signature.

In addition to the newspaper copy a selected list of 40,000 names was circularized by a four-piece mailing campaign. The number of sales, approximately 100, that could be attributed to the direct-mail campaign made it evident that the effort had been profitable.

Is This Hotpoint Range Coming To Your Home?
THINK what this wonderful, modern electric range means to Mother! Time for recreation or to spend with the kiddies, fewer kitchen hours, easier cooking, better cooking...without watching or guessing; a range easily kept "as clean as a china plate"; cleaner walls and ceiling; cooking speed. No range like it has ever before been made.
$10.00 down, Installed in Your Home
Take advantage of this special offer to install any model Hotpoint Electric Range in your home for a down payment of only $10.00. Come in today to our nearest office and select your range. You have only until November 25th until this offer is withdrawn.
Free
Don't Forget
Southern California Edison Company
Harry Crowe Hardware & Electrical Works
Tulare Electric Company
Linder Hardware Company
Hotpoint frees you from the kitchen
Now, EVERY Home Can Have a Hotpoint Electric Range
AS LITTLE as $10.00 down places any Hotpoint Electric Range in YOUR kitchen ...ready to use!
Until November 25th... you may arrange to pay the balance in six, twelve or eighteen months. The special low rate to range owners will effect a saving in your present light bill...enough to help pay for the range.
Decide today... to visit our nearest office and investigate this offer.
$10.00 DOWN
Installed
and this Waffle Iron
Free
RACE & LANDERS, INC.
GEO. DELANO ELECTRIC CO.
E. M. M. SERVICE, INC.
SOUTHERN CALIFORNIA EDISON COMPANY
Owned by Those it Serves
A MILLION FAMILIES COOK ELECTRICALLY
more on Hotpoint Ranges than any other ...
Yours...
a HOTPOINT Electric Range
only $10.00 down Installed
JUST think of it! For only $10.00 down payment we will install any model Hotpoint Electric Range in your home during this campaign, October 10 to November 25.
Now you can own one of these beautiful Hotpoint Ranges and pay for it while you are using it. Six, twelve or eighteen months to pay the balance.
Come in today and see the new models... Visit our nearest office and let us tell you more about this offer.
Free
Electric Cookery is Modern
SOUTHERN CALIFORNIA EDISON COMPANY
A. R. PARSONS & COMPANY
PORTERVILLE ELECTRIC COMPANY
WOODS-WATKINS ELECTRIC COMPANY

Typical range campaign advertising in local papers carrying names of co-operating electrical dealers on the copy.

Making a SURVEY of Merchandising

How a contractor-dealer sought out customers for merchandise where there did not seem to be any.

WHAT does the contractor do who finds himself for the first time with a merchandising establishment, after years of contracting alone? Is he downhearted because he finds his merchandising establishment located in what seems to be barren territory, although the same roof covers the contracting department which is ideally located in that it is out of the high rent zone?

H. H. Walker, Electragist of Los Angeles, found just such a situation. But the type of thinking which built up his contracting business logically step by step led him habitually to engineering methods to find the solution. If he was no merchandiser himself he would get a man who did know merchandising and give that man his head and see what he could do with a "hopeless situation."

Surveying the Field

When Fred Ayres, a retail department store merchandiser, was placed in charge of the appliance department of H. H. Walker, Electragist, over a year ago, he found a condition typical of many electrical stores, but new to him. The store was in an apartment house district on Venice Boulevard. A survey of the possible local field revealed to Mr. Ayres that to sell electrical appliances from that store would require extraordinary effort and ingenuity.

The immediate surroundings were medium grade apartment houses. People living in them could not use many appliances. Many landlords, supplying light, discouraged their use or forbade them. There was small possibility of selling washers, because of lack of room to keep them in small apartments. Other similar appliances were also difficult to place.

The store was not on a main pedestrian thoroughfare, although on an automobile boulevard. Casual shoppers would be few and far between.

Such were the liabilities.

The assets, however, were Mr. Walker, with unlimited faith extending a free rein. Here was a store and here merchandise. They were to be sold.

Laying the Plan

The situation left open two courses of action. The immediate field was more or less hopeless. It could not be neglected but there would be little use to pour much sales expense into it.

It would be necessary:

(a) to make the entire city a field and pull it to the store for a peculiar and unique service, first by intelligent advertising intelligently directed and, second, by actually giving that peculiar and unique service and bring business back again;

(b) to make the store attractive not to the passing pedestrian so much as to the passing motorist. The place must be made unique enough to be remembered when electrical appliances came to mind.

The building lends itself to the latter consideration. A large and attractive Spanish type building, it is, floodlighted at night and having large windows through which the passing motorist might be made to see a bright and attractive interior. The floor level of the entire store is raised to usual window level, making it possible to use the entire floor as a display.

Enclosing the yard from which the construction crews of the contracting part of the business operate, is a high stucco wall. This wall could be used for advertising. Mr. Walker insisted that the advertising painted on such walls should be of exceptionally attractive quality, so that the beauty of the entire building should be maintained and the usual billboard appearance avoided.

Thus the store itself was prepared for its peculiar type of selling.

Reaching Out With Letters

The means to be used by which to attract buyers to the store was determined upon. Direct mail seemed to be the logical method to use. Newspaper advertising, the reliance of the department store merchant, Mr. Ayres realized, would not pay its cost in this new situation. Letters to individuals, as a means of intensive sharpshooting, would yield better results.

"Attraction and information are the two essentials," thought Mr. Ayres, in pointing out how he wrote sales letters. "We strive to get some good phrasing

The merchandising store of H. H. Walker, Electragist, is on the main floor. The remainder of the building is devoted to the contracting departments, but the attractive and colorful signs on the building and the wall of the service yard catch the eye of passing motorists on busy Venice Boulevard.

Possibilities

and wording, but we never make a letter involved. We write the letters just as we would talk within our own family circle. The letters are never long, and we try to make them typographically appealing to the eye. We make the brevity of the letter stand out by unusual spacing, paragraphing, and so on. All letters are signed with pen and ink and give every indication of being personally dictated to each recipient."

In connection with the sending of letters the firm also sends out booklets furnished by manufacturers of electrical devices and appliances. However, these are not rubber-stamped, as Mr. Ayres explains that this gives them a cheap appearance, but they bear the imprint of the firm done by a reputable printer, matching the type used in publishing the booklets.

A very good example of the kind of letters used by the Walker firm to create more sales was sent out last Christmas. It was mailed about three weeks before the holidays to the firm's entire list of retail buyers and prospects. It was extremely short, not over 100 words long, and did not attempt to describe fully any merchandise, but rather gave a flash at the entire store and its offerings. Appealing to the people who live in the vicinity and the large residential community which reaches town by motoring over Venice Boulevard, it opened with:

"Santa Claus is just around the corner!"

Then followed mention of electrical gifts approved by Good Housekeeping, then a line for Fada radio. A separate paragraph announced that Christmas presents would be reserved on a small payment until Christmas. It closed with the reminder that there was plenty of parking space and that the store was "right in the neighborhood."

Not discouraged by the apartment resident situation, Mr. Ayres also determined to develop this market as much as possible and received results which are now beginning to reflect in yearly sales.

"First, we mailed to those nearest us," stated Mr. Ayres. "Then we took in a little bigger area farther away, and we are keeping this up, gradually expanding our field of mailing operations. We keep our lists up to date, so far as possible, by checking against the addresses in the telephone books as they are issued from time to time. As there are many apartment houses in the district, there are many not listed in the phone books, so we send a woman around to visit these apartment houses. She interviews the manager and gets the names of any new tenants, and checks off those who may have moved away from the district, but who are on our lists."

Mr. Ayres discovered then that the people living in apartment houses are a valuable list of prospects to cultivate after all. They generally have incomes equal to or greater than those having private residences, and the fact that they live in apartments is in itself indicative that, generally, they crave all of the living comforts and luxuries. Many are live prospects for all manner of electrical appliances, although radio is the best selling merchandise. Yet, because they are not generally listed in the telephone books and other lists common to all business houses, they are seldom reached with direct mail.

A distinctive, charming interior, flooded with light at night, attracts motorists passing outside.

Method Bringing Results

"While our merchandising is not yet what we would like to call completely successful," says Mr. Walker, "we have made consitent, steady progress, and I look for a time, in a year or two more, when we can credit the type of constructive building-up we are engaged in with a fair degree of success.

"My business was entirely a contracting business up to a few years ago. As an Electragist officer (Mr. Walker is serving his second administration as president of the California Electragists) I felt that I should know something of the merchandising side of the contractor-dealer business. So we started. But we determined that we should proceed along sound, intelligent lines. We persuaded Mr. Ayres, a man who knew merchandising, even if he didn't know electrical merchandise, to take charge. It seems as if the theory was sound for the business is growing better every year."

Bargain Counter Effect—Many merchandisers of electrical appliances and appurtenances have adopted the 15-cent-store method of displaying all articles such as lamps, fuses, duplex plugs, sockets, friction tape, radio insulators, and miscellaneous items of that character on a convenient table placed near the entrance of the store which everyone entering the store must pass. Such a display is always tempting to the person passing and if the articles are opened and can be felt and handled the sales are more readily made. Many people buy in that way articles which they select themselves but which they do not know how to name.

Guarantee Stresses Low Cost of Electricity

That manufacturers are assisting in telling the story of the low cost of electricity is given evidence in the message which is printed on the back of the guarantee given by the Edison Electric Appliance Company, Inc., with each of its Hotpoint appliances.

A familiar chart showing the relative rise in the cost of living and drop in the cost of electricity between 1915 and 1925 is followed by a statement to this effect:

The Low Cost of Electric Service

Your electric light and power company stands ever ready to serve you with the current to operate this appliance. For this 24-hour, day in and day out, dependable service, you actually pay less, if you are an average customer, than you did ten years ago. In the face of nearly double costs for food, clothing and shelter, as compared with pre-war prices, the average cost of electric service in the home is actually lower than it was ten years ago.

This reduction has been made possible by new inventions and improvements in methods of generating electric power and by careful and efficient management on the part of your light and power company.

With the cost of electricity so low, any woman who performs household tasks that an electrical appliance can do is working for a few cents an hour. When you buy an electrical servant you not only lighten your own labor at slight cost, but you make it possible for your light and power company to give you still better service.

News of the Industry

New Mexico Utilities Review Past and Plan Future at Annual Convention

ABOUT one hundred street railway, telephone and water company representatives, as well as electrical men from the states of Colorado, Wyoming, New Mexico and Texas, attended the thirteenth annual convention of the New Mexico Utilities Association held in Albuquerque Feb. 20-22.

J. B. LEDLIE
retiring president.

J. B. Ledlie, Mesilla Valley Electric Company, Las Cruces, N. M., former president of the association, opened Monday morning's session with a review of past accomplishments of the association and an outline of its future opportunities. He stated that to a large extent the matter of public relations is being handled satisfactorily, and that the industry has progressed splendidly in attacking problems of production and distribution. With this situation in hand Mr. Ledlie emphasized the necessity of giving major consideration to sales efforts. "This," he said, is of immediate importance and is our biggest job."

Miss Frances B. Ryder, chairman of the women's committee, Rocky Mountain Division, N.E.L.A., Pueblo, Colo., painted a picture of the increasingly large and important part that women are taking in the field of public service.

A. R. Woolley, Edison Electric Appliance Company, Denver, opened the afternoon sesson on Monday. His subject was "Central Station Merchandising from the Standpoint of the Manufacturer." Mr. Woolley asked if the utilities are analyzing the merchandise which they are offering to their customers from the standpoint of its dependability to give service and the integrity of its manufacturer. To explain his point he brought out that utility companies invariably purchase the best that the market affords in the matter of transmission equipment and line material, and that this is necessary from the standpoint of assuring uninterrupted service, but that unfortunately this same degree of consideration is not given to the electric appliance, the article that is actually depended upon to increase the load.

H. B. Dwight, engineer, Colorado Utilities Commission, devoted his talk principally to public relations. "Public relations is nothing more than public confidence," he said, "and confidence can be established in a large measure through the proper training and education of employees."

Dr. James F. Zimmerman, president of the University of New Mexico, outlined difficult problems in the field of education that constantly confront present-day educators.

"Public Relations—the New Concept," was the subject discussed by V. L. Board, general superintendent, Public Service Company of Colorado, Denver. Mr. Board brought out that prejudices that exist against the public utilities are not due to the utilities themselves, but rather are inherited. These prejudices are rapidly being dissipated, however, through the medium of education.

"Why All the Secrecy?" was the subject developed by George E. Lewis of the Rocky Mountain committee on public utility information, Denver. Mr. Lewis stressed the necessity on the part of utility managers of letting their employees in on the results obtained from conventions such as the present one.

J. J. Cooper, of the Mountain Electric Company, Denver, had for his subject, "What Price Success?" Mr. Cooper drew very largely upon the valuable data recently compiled by Earl E. Whitehorne, commercial editor, Electrical World, and broadcast by Mr. Whitehorne under the title, "The Next Big Problem." Mr. Cooper's talk was one of the features of the convention, outlining as it did the "new competition" and emphasizing the necessity for intensive market development.

H. C. Webb, Jr., sales manager, El Paso Electric Company, El Paso, Texas, in his talk, "Merchandising to the Home," stated his belief that there is an immediate necessity for selling the value of appliances and electric service to the customer, not necessarily through the inauguration of spasmodic campaigns or the offering of premiums, but through continuous selling effort.

Tuesday morning's session was given over to a complete discussion of the Colorado River development. Following a brief review of the situation by Merrit C. Mechem, of Aubuquerque, Francis C. Wilson of Santa Fe, Colorado River commissioner for the State of New Mexico, explained the many features of the proposal in detail.

"Central Station Possibilities in Street and Highway Lighting" was the subject handled by A. S. Anderson of the General Electric Company, Denver. Mr. Anderson drew largely upon a report of recent investigations of the N.E.L.A. street and highway lighting committee.

C. C. OGLE
newly elected president.

Philip S. Donnell, dean of engineering, University of New Mexico, presenting "The Problem of Power Factor," brought out that low power factor has come to be recognized as one of the major handicaps to central station service.

The subject, "Recent Engineering Developments in the Electrical Industry," was handled by R. W. McNeill, Westinghouse Electric & Manufacturing Company, Denver. Mr. McNeill confined a great portion of his discussion to the advancements that have been made recently in steam turbine construction.

A. C. Cornell, of the Graybar Electric Company, Denver, concluded Wednesday morning's session with a talk on "Possibilities of Developing an Electrical Consciousness." Mr. Cornell drove home the fact that if the electrical industry in the past had done the job of selling the industry to the public, it would not have had to fight such proposed legislation as the Swing-Johnson Bill.

Officers elected to serve the New Mexico Utilities Association for the ensuing year are: president—C. C. Ogle,

Idaho Company Increases Merchandising Facilities

In order to provide adequate merchandising facilities at its Nampa office the Idaho Power Company recently remodeled its sales room, with the attractive results shown. A special feature of the remodeling is the recessed panels on each side of the entrance in the vestibule which are fitted with plate glass doors and shelves and serve as outside display cabinets for small appliances.

Agua Pura Water Company, Las Vegas; first vice-president—W. W. Nielson, Santa Fe Water & Light Company, Santa Fe; second vice-president—C. S. Makeig, Roswell Public Service Company, Roswell. B. L. Wiles, of the Albuquerque Gas & Electric Company, succeeds himself as secretary-treasurer. On the executive committee are C. C. Ogle, C. S. Makeig, J. B. Ledlie, W. W. Nielson, Arthur Prager, A. Kneipp and R. L. Bowen.

Delegates to the convention were particularly well pleased with the varied entertainment features arranged by Arthur Prager, chairman of the entertainment committee. Assisting him were Mrs. Arthur Prager, Mr. and Mrs. B. L. Wiles, and George E. Lewis.

Lack of Construction Work May Invalidate Water Rights

Water rights claimed by appropriation and held over a period of years are not valid unless some actual physical construction or development work has been done within the period, according to an opinion rendered by B. B. Adams, assistant attorney-general in response to a query by R. K. Tiffany, Washington Supervisor of Hydraulics. The carrying on of surveys, stream gaging, preparation of plans and purchase of rights-of-way do not constitute such actual development, in the opinion of Mr. Adams.

The question arose through the protest made by Robert Howes of Seattle against the application of the Great Northern Power Company for permission to appropriate water for power purposes from the East and West Forks of the Wallace River, Snohomish County. Mr. Howes claimed the right to the use of the water both as a riparian owner and as an appropriator of water under notices posted prior to enactment of the 1917 water code. The protestant had made surveys but he had not taken steps to secure additional storage or diversion rights which would be needed to carry out a comprehensive project, nor had he done anything which could reasonably be considered as construction work, according to Mr. Tiffany.

Change in Financial Set-up of Edison Company Voted

Stockholders of the Southern California Edison Company, at the annual meeting on March 16, approved the following suggestions of the management: A proposal to increase the company's preferred and decrease its common stock, and to issue $5,000,000 par-value common stock to employees at not less than par ($25).

John B. Miller, chairman of the board of directors, presided and explained that the ideal financial set-up for the company would be to have 50 per cent bonds, 30 per cent preferred and 20 per cent common stock. More nearly to approach this ideal, it was decided to decrease the authorized amount of common stock from $125,000,000 to $100,000,000 and to increase the amount of preferred "C" stock from $20,000,000 to $45,000,000.

A. N. Kemp, vice-president of the California Bank, was elected a director; other directors were renamed.

Mr. Miller pointed out that the Edison company closed 1927 with no floating debt for the first time in its history. At the same time it had about $5,000,000 cash on hand, which, he said, "is just about as strong a position as any corporation can find itself in."

Upbuilding of California Electragists Is Endorsed by All Branches of Industry

CONCEDING the importance of the electrical contractor-dealer in the industry's big task of market development, central stations, manufacturers and jobbers, through their representatives at a meeting held in San Francisco March 16, commended the desire of the California Electragists to build up a larger and stronger organization, endorsed the plan for self-education and industry co-operation under which the Electragists are operating, and expressed a willingness to assist them in every way possible in their efforts to create progressive merchandising outlets.

C. T. Hutchinson, president, McGraw-Hill Company of California, and chairman of the advisory committee of the California Electrical Bureau, presided. He announced that the meeting had been called by the advisory committee for the purpose of stating the case of the Electragists, asking for the support and co-operation of the other branches of the industry, and receiving statements of their policies with regard to the Electragist movement.

He drew attention to the "new competition," which is forcing the electrical industry to compete with other industries for a larger share of the consumer's dollar, and stated that "it is obvious that unless the electrical industry, acting as a unit in all of its four branches, does an infinitely better selling job than it has in the past the growth of our industry is going to be seriously retarded if not stunted." After referring briefly to the work of the California Electrical Bureau in helping the contractor-dealer to become a better and more efficient merchandising outlet, Mr. Hutchinson said that the united efforts of all branches of the industry in that work now are essential. He then introduced C. J. Geisbush, state manager of the California Electragists.

Mr. Geisbush also referred to the "new competition," pointing out that the electrical contractor-dealer had been urged by all branches of the industry to take advantage of the interest created by the several campaigns waged to develop the market, that as the market development plans gained impetus the contractor's interest had increased "until today the electrical contractor-dealer with intelligent self-interest is taking his place beside the other branches of the electrical industry in the numerous market development campaigns." The speaker pointed out that there still are, however, in the ranks of the contractors some who through ignorance, lack of vision or laziness refuse to co-operate in any industry campaign for the development of the market, and whose practices tend to nullify the best efforts of the combined constructive sales activities of the industry.

This lack of vision is not confined to contractors, according to Mr. Geisbush, who cited several instances in which power company representatives had acted to undo work already done by a contractor, and had endeavored to spoil sales by implication that the

contractor would not render service and that the work would not be well done. Said Mr. Geisbush:

Inference of implication, when used by a power company representative to indicate to a prospective customer that the progressive contractor is not equipped to render service or supply equipment of equal value, defeats the very purpose of our market development plan. Such argument implants in the minds of the buying public the idea that the power company's office is the only place where electrical service or equipment can be obtained with entire satisfaction. Within the industry such a selfish attitude breaks down the confidence of the interested electrical contractor, destroys his initiative, and tends to impede the results from our united efforts.

The market development plans of electrical industry will fall short of their desired goal as long as short-sighted contractors continue to obstruct the extensions of electrical service through ignorance or design. The industry will never fully realize its desire to be a "united industry" while power company salesmen, in their eagerness for commission, use inference and implication to defeat a sale by a progressive and forward-looking electrical contractor.

Two things would tend to remedy the situation, Mr. Geisbush pointed out —education for the ignorant, short-sighted contractor, and for the power company salesman "a clear-cut decisive declaration of the head-office policy with instructions to play the game according to fair rules and avoid the job already covered by the electrical contractor."

Mr. Geisbush offered as a solution of the so-called "contractor-dealer problem" "a more general and sympathetic understanding and a broader and more constructive application of the principles represented by the California Electragists." He stated that the work of the California Electragists is divided into two general classifications, self-education and industry co-operation. "Self-education includes group activity for the analysis and discussion of the three major field activities, accounting, estimating and merchandising," he said, and explained how the work was carried on.

"On industry co-operation . . . meetings are held regularly between our trade policy committees and the representatives of the jobber group for the discussion of trade policies, merchandise distribution, credits, accounting; in fact, any question of mutual interest is carefully analyzed.

This contact is maintained to insure a continuation of the harmonious relations between the contractors and the jobbers, and it makes an effective contact for the elimination of current misunderstandings, which tend to retard the spread of industry loyalty and industry consciousness. As an example of the result of this work, we cite the excellent co-operation given by the jobbers in instructing their salesmen to work constantly in the interests of the contractor-dealers, and to act as associate fieldmen of the California Electragists and the California Electrical Bureau in stimulating interest in all group meetings held in the various districts.

Our contact with manufacturers is more difficult to establish because of the diversity of products and interests. During the past year the California Electragists created two motor sections in the State of California for the discussion of trade policy with the manufacturers of motors and motor control equipment. Meetings are held regularly once each month in Los Angeles and San Francisco.

Ranking with all other industry activities in importance, comes our contact with central stations. Trade policy committees, similar to those who contact the jobbers and manufacturers, meet regularly with the officials of the power companies to discuss the many questions which involve our mutual relations. When we find a lack of harmony between contractors or electrical retailers and local central station representatives, a meeting is called to determine the cause of the trouble and clear it up by argument and discussion.

In concluding Mr. Geisbush said:

To create public acceptance of the electrical idea, all forces of the industry are needed. With this task before us, we have no place for family quarrels, petty bickerings and misunderstandings. We stand for united industry in all that the term implies. We have enrolled as members approximately 20 per cent of the total contractors in the state, and we represent approximately 15 per cent of our national membership. On some sides we find this lack of membership an indictment against the California Electragists. Actually this lack of membership is an indictment against the electrical industry. The industry needs wide-awake, progressive, creative retail outlets. If an insufficient quantity of these outlets now exists, the industry must build them. The California Electragists offer the solid foundation upon which to build. It becomes your job as industry men to help with the erection of the structure.

R. E. Fisher, vice-president, Pacific Gas and Electric Company, in charge of public relations and sales, was the next speaker. He commended the desire of the Electragists to get on their feet and stated be believed the entire industry should co-operate with them. Mr. Fisher conceded that there had been much misunderstanding between the contractor-dealer in the field and the power company and that the matter of servicing had been one of the major causes of contention. He expressed the intention of having placed in the hands of every power company salesman a copy of the company's agreement on servicing of ranges and other heavy-duty appliances in an effort to avoid further misunderstanding on this score. Mr. Fisher then read the following policy of the Pacific Gas and Electric Company with respect to electrical merchandising:

We believe that the public must be served.

That best public service can only come from a united electrical industry.

That an organized and united industry is essential if the maximum amount of business is to accrue to the four major electrical groups through creation of consumer acceptance of our products

That such a united industry will successfully compete with other organized industries to the end that a fair share of the public buying power will be obtained.

That the manufacturers and jobbers can best contribute to this plan by supplying well advertised merchandise of unquestionable quality at prices which permit the seller a sufficient profit margin.

That merchants and dealers can and should retail electrical merchandise at prices fair to themselves and the public by such methods as have been found to be sound by successful retailers.

That the power company, in addition to supplying quality service at fair rates, assume leadership in the sale of quality merchandise at retail prices, adhering to ethical merchandising methods on a basis where all legitimate retailers may successfully compete.

That such ethical leadership has stimulated and will continue to stimulate public buying of appliances, wiring, current, and general supplies.

That it is the duty of the utility particularly to do pioneer selling in that appliance field where there is no public demand or due to special conditions, no adequate retail profit.

That it is the desire of the Pacific Gas and Electric Company to encourage as many legitimate retail appliance dealers as can economically operate; to co-operate with such natural outlets by financing and executing constructive educational selling and advertising campaigns.

To keep an open mind. To be guided by facts. To hold out to all groups the right to full discussion. To hold to those policies we believe to be right but to quickly concede where we find we are wrong.

In closing, Mr. Fisher requested all those division managers of his company present to get behind the Electragist movement and the principles as enunciated by Mr. Geisbush.

R. A. Sharon, assistant to A. E. Wishon, vice-president and general manager, Great Western Power Company, endorsed all that Messrs. Hutchinson, Geisbush and Fisher had said and stated that all of the division and sales managers of his company would go back to their districts with instructions to support the Electragist movement. He stated that the Great Western Power Company stood for co-operation with all branches of the industry and gave it as his opinion that get-together meetings in the various districts would eliminate 99 per cent of misunderstandings such as had occurred in the past.

"The neck of the bottle" was the term applied to the contractor by Fred Todt, of the Pacific States Electric Company, speaking for the jobber group, "because appliances cannot be sold unless installation has been made convenient." "A substantial percentage of the jobbers' business comes from electrical contractors," said Mr. Todt, "and we recognize that unless the contractor-dealer develops, expands and profits, the outlet for our merchandise in that direction is restricted." He expressed the opinion that differences, due to misinterpretation and misunderstanding of policies, could be ironed out in the localities where they occur if there was more contact between the individuals concerned. Mr. Todt stated that the jobbers are committed to do anything they can within reason to assist in the upbuilding of the Electragists' organization and that they "propose to put on a concentrated drive to stimulate interest among those who may not now be members of the Electragists in the benefits that may be derived by them in joining that organization." Mr. Todt made a plea for a "reasonable degree of tolerance" and ended with the statement, "The jobbers are 100 per cent behind the Electragist movement."

"The greatest progress in the electrical industry and in the use of electricity is being made where there is aggressive activity on the part of all of the branches in a community," said R. M. Alvord, San Francisco district manager for the General Electric Company, in voicing the sentiment of the manufacturers. He expressed his belief that the policy of the Electragists is fundamentally sound and saw no reason why all branches of the industry could not get together with an open-minded attitude and adjust whatever differences might arise.

In closing the meeting Mr. Hutchinson made a plea for the prompt adjustment of differences as they may occur in the future and expressed the hope that all present would go away imbued with the idea of helping to build up the membership of the California Electragists.

Executive Personnel Changes Are Made by Edison Comany

Important changes in the executive personnel of the Southern California Edison Company were announced following a directors' meeting held after the stockholders' annual meeting in Los Angeles on March 16. R. H. Ballard,

JOHN B. MILLER

formerly executive vice-president and general manager, was elected president; John B. Miller, who for many years has served as president and chairman of the board, was elected to the position of chairman; and George C. Ward, formerly vice-president in charge of operations and construction, was made executive vice-president.

Commenting on these changes, Mr. Miller said: "The election of Mr. Ballard to the presidency is a well deserved recognition of his great services to the company and is a move designed to increase his efficiency and usefulness, not only to the corporation, but the community.

"I shall take the same keen interest in the company's affairs that I have for 30 years, and shall continue to devote myself particularly to the company's finances, its welfare work and to its general policy. Under the new conditions, however, I shall be able to view the company's operations from a somewhat broader viewpoint.

R. H. BALLARD

"Mr. Ward, who succeeds Mr. Ballard as executive vice-president, has been with the company and with the Pacific Light & Power Corporation, which the Edison company took over, since 1911 and is an engineer and utility operator of national repute."

Mr. Miller recently celebrated the completion of thirty years of service with the Edison company. On Feb. 1, 1898, he became associated with the Edison Electric Company, the predecessor of the present organization, as treasurer, and held that position until 1901 when he was elected president. Eight years later the company was reincorporated as the Southern California Edison Company with Mr. Miller as president, and in 1918 he was made chairman of the board.

Mr. Miller, a prominent figure in the electrical industry of the West, always has taken an active interest also in the affairs of the National Electric Light Association of which he is vice-president. In 1920 he acted as chairman of the national convention committee. In the commercial field he has very wide interests and is an officer and director of many companies.

Mr. Ballard, who began his career in the electrical industry as office boy with the Thomson-Houston Electric Company of Chicago in 1890, came to California thirty-one years ago and was engaged as auditor by the Westside Lighting Company, to which the present Southern California Edison Company

G. C. WARD

traces its source. With the exception of a short interval when he served the Butte Electric Company in Montana, Mr. Ballard's service with the Edison company has been uninterrupted. Since 1920 he has held the position of general manager and since 1924 has served as executive vice-president and general manager. He is a past president both of the Pacific Coast Electrical Association and the National Electric Light Association and is at present chairman of its national public policy committee.

Mr. Ward, who a year ago had conferred upon him by the University of California the honorary degree of Doctor of Engineering for his outstanding work in that field, began his career in railroad work. In that connection he was associated with Collis P. Huntington and later with Henry E. Huntington. Since 1912 when the Big Creek-San Joaquin River project of the Edison company first was conceived, he has had active supervision of that work.

Great Western Company Plans to Acquire Feather River Co.

Control of the Feather River Power Company will pass to the Great Western Power Company of California if the application recently filed is granted by the California Railroad Commission. The application provides that controlling stock interest of the Feather River Power Company is to be purchased by the Western Power Corporation of New York, but shall be reconveyed at the original purchase price within two years to the Great Western Power Company of California, its subsidiary.

The property of the Feather River Power Company is situated on Bucks Creek, a tributary of the North Fork of the Feather River, and includes reservoir capacity of 110,000 acre-ft. and a plant of 55,000-hp. generating capacity. This plant is the highest head plant in America, having a static head of 2,561 ft. Under a previous agreement the Great Western company had contracted for the purchase of all power developed on the Bucks Creek power development project of the Feather River Power Company for a period of 35 years, and at the end of that period the Great Western company would have become the owner of the Bucks Creek plant.

The properties of the Feather River Power Company have a value of approximately $9,000,000. The construction work has been carried on by the R. C. Storrie Company, under the supervision of the Constant Angle Arch Dam Company, and it is estimated that the plant will be fully completed by July 1 of this year.

Central Arizona Company Sets Up Budget of $1,107,975

In 1928 $1,107,975 will be spent by the Central Arizona Light & Power Company, Phoenix, for the construction of power lines, gas mains, and expansion of its plants, according to a report on the budget of that company given out by its officials.

The largest portion of this budgeted sum, $500,000, will be spent in the enlargement of the present electrical plant, together with the purchase and installation of a new 12,000-kw. frequency changer. This machine will be used in connection with the 25-cycle power purchased under a long-term contract with the Salt River Valley Water Users Association for power from the proposed Stewart Mountain project development.

Another item in the construction plan calls for the building of an electrical transmission loop line, and the construction of additional substations within the territory served by this company.

El Paso Company Receives Safety Medal—An Anthony N. Brady Memorial Medal for outstanding accident prevention and health promotion work on electric railways for the year ended Dec. 31, 1926, has been awarded to the El Paso Electric Company.

Head of Los Angeles Utility Tenders Resignation

William Baurhyte, who has been president of the Los Angeles Gas and Electric Corporation since February, 1924, has tendered his resignation as

WILLIAM BAURHYTE

chief executive, to be effective March 31. Addison B. Day, now executive vice-president and general manager of the organization, will succeed Mr. Baurhyte as president.

Mr. Baurhyte has expressed his intention of taking an extended vacation from business duties. Prior to his becoming president in 1924, he was vice-president and general manager. His service with the corporation dates from Sept. 1, 1903, when he was called from the ranks of the Pacific Gas & Improvement Company to accept the second vice-presidency.

Mr. Day's entire business career has been spent in the service of the utility which he will head. He entered the employ of the Los Angeles Light Company, predecessor of the Los Angeles Gas and Electric Corporation, in charge of the gas-stove department, Feb. 1, 1895. He has risen successively to the positions of bookkeeper, chief clerk in the gas department, chief clerk in the electrical department, manager of the appliance department, auditor, assistant secretary, manager of operation, gen-

ADDISON B. DAY

eral superintendent, vice-president and executive vice-president and general manager. He will retain his duties as general manager in connection with the presidency.

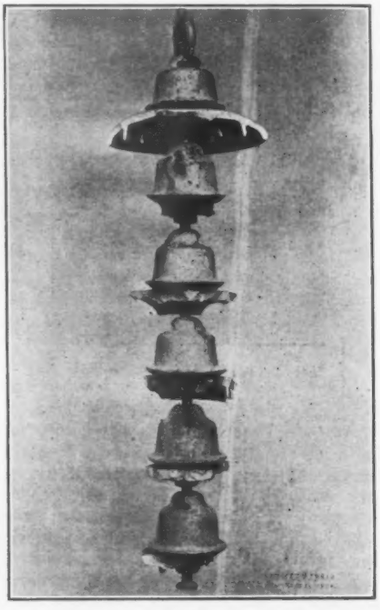
B. C. Company Plans Erection of Merchandising Building

Contract for a three-story steel and reinforced concrete structure has been awarded by the British Columbia Electric Railway Company, Ltd., for a building which will be situated at Dunsmuir and Granville Sts., Vancouver, and will be used for merchandising purposes.

The first floor will be a general showroom with cashier's office in the rear. The second floor will house an auditorium for cooking demonstrations and several model kitchens, laundry and rest rooms. Offices, stock rooms and a display of heavy equipment will occupy the third floor. Heavy-duty appliances also will be set up in the basement.

Units concealed in urns will illuminate the interior of the store and color lighting effects will be obtained by means of automatic dimmers. A feature of the building will be show windows built without backs so that the entire store will be visible from the street. The lighting system planned for these windows will be of high intensity and will allow of a variety and combination of colors.

Insulator Target Plus Rifle Equals Short Circuit



When this insulator string on the Puget Sound Power & Light Company's 110-kv. transmission line near the summit of the Wenatchee Mountains in Washington was used as a target by a thoughtless rifleman a short circuit resulted which caused curtailment of service for several hours. Due to the extreme inaccessibility of the line at that point, it took an entire day to locate the source of the trouble and repair it. The company published an offer of $500 reward for information leading to the arrest and conviction of the marksman.

Edison Company Employees Publish Bulletin—Busy Buttons' Bulletin, published "by, and for, the employees of the Southern California Edison Company," is a new house organ which made its appearance with the February issue. Its purpose is stated in this first issue thus: "We Edison folks, with our families, make up a population of 25,000 to 30,000 people. To us, anything that any Edison people do, anywhere, is news. The purpose of the bulletin is to bring us this news, while it is still reasonably new, to give us more of an opportunity to feel that we have a hand in all Edison doings." The first number is a newsy, four-page publication, well illustrated, and credit for it goes to the editor, R. G. Kenyon of the company's advertising department.

A. I. E. E.

Papers Winning Regional Prizes for 1927 Announced

Papers winning the 1927 annual regional prizes of $25 offered to student members and members not students were chosen at the meeting of the executive committee, Northwest geographic district, American Institute of Electrical Engineers, held at Spokane on March 10.

A prize of $25 for the first and best paper by a member other than a student was given to R. Rader, of the engineering department, Puget Sound Power & Light Company, Seattle. The title was "A Discussion of Short Circuit Problems and the Application of the Testing Board to Their Solution." Honorable mention was awarded to Earl Baughn, Washington Water Power Company, Spokane, for his paper on "Alternating Current Underground Distribution System in Spokane, Wash."

The $25 prize for the best paper by a student of engineering colleges in the district was awarded to F. D. Crowther and Richard L. Earhart, seniors at the Oregon State College, whose subject was "Alternating Current Transients in Incandescent Lamps." C. M. Briggs, student of the University of Washington, writing on "The 500-Mile Transmission Line with Distributed Syncronous Condensers," also won honorable mention.

San Francisco Section—A joint meeting of the student branches of Stanford University, University of California, and Santa Clara University will be held April 13 at Stanford under the direction of the San Francisco Section, A.I.E.E. The program, arranged by the students, will be presented following a dinner at Stanford Union. Plans are under way for the San Francisco Section to visit the U. S. Navy's airplane carrier Saratoga, which is expected to arrive in San Francisco Bay some time in April. As the date of arrival is uncertain, details of the trip will be announced later by the section.

Pacific Coast Electrical Association

Plan for Educational Survey Is Explained at Meeting

In order to determine to what extent educational institutions are co-operating with public utility companies in an endeavor to train their students to take up the work of those companies, and to what degree the utility companies are interested in having the educational institutions so co-operate, a national survey is being made. In the electrical industry the work is being sponsored by the National Electric Light Association through the Public Relations Section's committee on co-operation with educational institutions. C. O. Ruggles, of the College of Commerce and Business Administration of the Ohio State University, is directing the survey.

Members of the Pacific Coast Electrical Association were given an opportunity to hear Dean Ruggles explain the plan of the survey and the results hoped for from it at a meeting of the local committee on co-operation with educational institutions held March 1 in San Francisco. A. H. Markwart, vice-president of the Pacific Gas and Electric Company, in change of engineering, and chairman of the committee, presided.

Dean Ruggles stated that the first step in the survey has been the preparation of a questionnaire to be submitted to utility executives. The questionnaire covers such subjects as the courses being taken by public utility employees in local educational institutions and, where there is no such arrangement, whether it would be desirable for the local educational institutions to provide such courses as principles of economics, elementary accounting, marketing and merchandising, corporation finance and similar courses; co-operative employee educational programs with other public utility companies or educational institutions; temporary employment for college men; leave of absence for capable employees for study or research; scholarships or fellowships; interviewing students about to graduate with reference to employment; opportunities for advancement in the public utility field; success of college graduates.

Another questionnaire has been prepared covering suggested data to be obtained from educational institutions on courses and research in colleges and universities in the field of public utilities and on vocational interest in this field. These will be mailed out by the committee to the various universities and colleges.

After the answers to both questionnaires have been received they will be analyzed and discussed by all members of the committee, who in the final analysis will decide what will go into the first report. It was pointed out that all that it was hoped could be done in the first report was to present problems and get the members of the industry interested.

The meeting was thrown open for discussion and some of the members of faculties of nearby educational institutions present were asked to give their views. A number of interesting points were brought out. W. L. Frost, president of the Pacific Coast Electrical Association, was introduced and spoke briefly on the work that the Southern California Edison Company had been doing along the lines of training college graduates in its organization.

Advertising Section Convention Activities Planned

At a meeting of the Advertising-Publicity Section, P.C.E.A., held in Los Angeles March 9, "Electricity Is Cheap —Use More of It" was decided upon as the subject of the three-minute speaking contest to be held at the convention luncheon on Tuesday under the direction of the section. Entries are limited to public utility representatives; major department heads, executives, division and district managers are barred. Each company may secure its entry by its own plan, but it is suggested that individual companies hold their own elimination contests and offer suitable prizes to arouse interest and create competition. Names of all entries must be in by June 1. The prize is, as last year, $100 worth of a member company stock and a $25 merchandise prize. Details of the contest will be handled by D. L. Scott, Los Angeles Gas and Electric Corporation.

Al C. Joy was named chairman of a committee to handle the preparation of a motion picture film embodying the work of advertising, as the section's entry in the convention contest among the various sections for the best "animated" presentation at the Wednesday morning session of "How This Section Can Best Help Load-building."

The subject of the Thursday morning session, "What This Section Believes Is of Most Importance and Greatest Interest to the Entire Convention," is to be presented for the section by Al C. Joy in the nature of an "animated" discussion of the development of the state, the problems of its industries and the part of the electrical industry therein.

The cast of the playlet to be presented by the section at the Friday morning session will be made up of professionals instead of members of the section. Further report of progress will be made by Mr. Joy at the next meeting, which is set for May 4 in San Francisco.

Famous Smoki Snake Dance to Be Feature of Arizona Utilities' Convention

WHAT is believed to be the most novel feature of a utility convention in a decade is the introduction of members of the Smoki tribe of Arizona

A Smoki snake dancer with his snake (real —not imitation) partner.

in one of their far-famed snake dances at the Arizona Utilities Association's annual convention and joint meeting with the Pacific Coast Electrical Association and the Pacific Coast Gas Association to be held at Prescott, Ariz., April 26-28.

It was not without some difficulty that Chief Spear of the Smoki tribe was persuaded to send dancers to Prescott for the convention. The Smoki snake dance is nationally famous, and it is expected that the opportunity to see it will attract many utility men from the west coast.

Full details of the programs planned for the different sessions of the convention have not been announced, but a number of interesting and important papers are scheduled for presentation. Among the speakers will be W. L. Frost, president, Pacific Coast Electrical Association, and J. G. Rollow, past chairman of its Engineering Section; H. L. Masser and H. E. Davidson of the Pacific Coast Gas Association. C. C. Cragin, Salt River Valley Water Users Association, will speak on "Public Relations."

Entertainment stunts are rumored to be unique and decidedly pleasing. Golf on unusual links, inspection of copper mines and mills, visits to prehistoric ruins and other features are definitely arranged for the convention.

Special airpline passenger service will provide novel transportation for those caring to use that means of travel between Phoenix and Prescott. Another

special plane will make sight-seeing trips around the country surrounding Prescott, besides taking a party to view the Grand Canyon by sunset, returning in time for dinner.

W. C. Hornberger, president of the Arizona Utilities Association, has extended a cordial invitation to all members of the Pacific Coast Electrical Association and the Pacific Coast Gas Association who are interested in constructive discussion and who enjoy real fun to be present at the convention.

Inquiries or reservations should be addressed to either the Arizona Utilities Association, Phoenix, Ariz., or to E. E. La Rue, The Arizona Power Company, Prescott, Ariz.

Northwest Electric Light & Power Association

Essay Contest Is Sponsored by Women's Committee

At the suggestion of George L. Myers, chairman Public Relations Section, Northwest Electric Light and Power Association, the women's committee is sponsoring a prize essay contest on the subject, "The Woman's Role in Public Relations." Those eligible are the women employees of utilities and of manufacturing companies, members of women's committees, with the exception of members at large and company chairmen, and utility employees' wives who are members of women's committees, Northwest Division. The essay is limited to 1,500 words, and the contest will close April 30.

Rules provide that a preliminary essay contest shall be held by each member company entering the contest, and the winning essay in each class then shall be submitted to Miss Mary K. Walsh, chairman women's committee, care of The Washington Water Power Company, Spokane. These essays then will be forwarded to the chairman of the executive committee of the Public Relations Section or to a prize awards committee named by the chairman of that committee or by members of the committee. A cash prize of $25 will be awarded the winner in each class of contestants, and it is suggested that the member company by whom the successful contestant in each class is employed, give to the winner a trip to the annual convention of the Northwest association with all expenses paid by that member company. It is also suggested that if the winner in any class should be employed by a member company in Portland, where the convention is to be held, that company offer a cash reward of $25 in lieu of the trip to the convention.

Engineering Section Holds Fifth Annual General Meeting in Spokane

ATTACKING problems of design, construction and operation by analysis and exposition, the Engineering Section of the Northwest Electric Light and Power Association held its fifth annual general meeting at the Davenport Hotel, Spokane, March 8-9, 1928. The usual custom of having each committee present for general discussion of topics pertinent to its work was followed with success. The Washington Water Power Company made available trips to all of its properties in and around Spokane.

M. W. Birkett, vice-president and general manager, The Washington Water Power Company, Spokane, in welcoming the delegates endorsed the idea of holding sectional meetings in the middle of the year at which technical subjects could be gone into intensively, so that the program of the annual convention could be made more general in character. R. M. Boykin, manager central district, Puget Sound Power & Light Company, Seattle, and vice-president of the Northwest association, spoke of the apprentice course conducted by his company for technical graduates.

A. B. Campbell, of the N.E.L.A. headquarters engineering staff, told of the work carried on by his department acting as the representative of the power companies in national matters.

E. C. Stone, chairman, Engineering National Section, sent a message emphasizing the principal problem before engineers of the industry—to produce more kilowatt-hours per dollar of investment. The first part of the problem, to obtain more kilowatt-hours per kilowatts of system capacity, is primarily a commercial job on which the engineer can render considerable assistance through developing new uses, the second part, to produce more system capacity per dollar of investment, is distinctly an engineering job.

A summary of the subjects presented by the various committees follows:

Accident Prevention Committee

J. B. Fisken, The Washington Water Power Company, chairman.

Information in possession of the accident prevention committee shows that aside from the humane and moral aspect of accident prevention work, the application of safety methods produces large monetary returns which give it an economic importance. Martin Flyzik of the Washington department of labor and industry urged a continuance of power company safety activities, pointing to the steadily decreasing aggregate of accident claims in spite of an increase in the number of man-days worked, which improvement has been brought about by educational efforts. He particularly urged that the industry continue its efforts to educate all workmen in resuscitation.

Other points discussed included tree trimming with its involved hazard and public relations angle and included also a discussion of the responsibility of the power company to the linemen with respect to linemen's tools. A legal report on a certain pertinent case described indicated that the companies cannot avoid liability by attempting to make the limemen responsible for the condition of their equipment.

Electrical Apparatus Committee

D. W. Probstel, Portland Electric Power Company, chairman.

Discussion of the operating practices of Northwest companies in the use of lightning arresters brought out a conclusion that each contemplated possible installation of lightning arrester equipment should be decided according to its own local conditions. It was brought out with some emphasis that smaller stations with spare transformers or dual supply service usually did not warrant the expense of lightning arrester installations, due to mild lightning conditions in the Northwest. Common practice in the case of important stations, however, is to install rather complete lightning protection.

Mercury rectifier sets and their growing use in place of motor-generator or converter sets for certain classes of d.c. service were discussed at some length, particularly the installation of two 750-kw., 1,400-volt, steel-tank mercury rectifier sets for interurban railway service in Portland.

Hydraulic Power Committee

E. H. Collins, The Washington Water Power Company, chairman.

Data pertaining to plant layouts used by Northwest companies are being gathered for inclusion in the annual proceedings.

Importance of the national study on the subject of reliability of hydro-electric units was stressed by the chairman who urged that all Northwest companies carry their operation records in such a way that information of value may be contributed from the Northwest to the national committee on this important subject.

The Wahlman intake tube was described in a paper sent in by R. L. Hearn, consulting engineer of Niagara Falls, Ontario. This type of intake has been used on the Chelan project of The Washington Water Power Company and many advantages are claimed for it.

An illustrated description of the Chelan project also was presented, outlining the various stages of the development from the initial snow study to the completion of the power house.

Inductive Co-ordination Committee

G. E. Quinan, Puget Sound Power & Light Company, chairman.

An agreement has been reached between communication companies and power companies as to the fundamental bases upon which differences between them should be settled although questions pertaining to allocation of costs remain yet to be definitely settled. Both interests recognize that the controlling factor in the whole question is that of finding the solution that will be cheapest in the long run, as far as the public is concerned.

Regarding radio interference, power companies now pretty generally recognize the responsibility for clearing major sources of interference from power lines and power equipment, but cannot accept responsibility and incident costs for clearing the minor cases that might interfere only with "distance" reception. An illustrated analysis was presented showing the causes of radio disturbance from power lines and demonstrating how potential differences between the charges carried by various pieces of line material and hardware caused sparks to jump between them with resultant radio interference.

Meter Committee

R. E. Thatcher, Puget Sound Power & Light Company, chairman.

New developments in the meter line seem to be in the direction of compensation for high overload of small capacity meters in order to secure greater accuracy.

Discussion of six methods of testing distribution transformers to determine loading efficiencies showed that good results were obtained by the use of a standard device for indicating the spread between oil temperature and ambient temperature. The use of this metering device makes possible greater distribution transformer efficiency by permitting the placement of transformers in the proper location as regards their load capacities.

Overhead Systems Committee

T. A. Purton, Idaho Power Company, chairman.

Steps in the development of the National Safety Code as it pertains to the strength

requirements for pole lines and as related to the national subcommittee on loading and strength of aerial lines, were reviewed. Northwest data on line failures by reason of glaze storms, weather bureau statistics and reports on such storms, and data pertaining to existing heavily loaded lines that have proved satisfactory in service are being collected by the Northwest unit of the national subcommittee.

Pictures and information describing useful equipment for handling poles, transformers and other heavy construction material were presented.

Outlines of several years' experiences with primary and secondary networks in Seattle overhead distribution indicated the following advantages: economy in first cost and operation; better consumer voltage regulation; improved service due to fewer transformer burnouts; greater facility for safe use of common neutrals for primary and secondary with freedom from telephone interference and saving in copper.

Tests conducted by A. O. Austin of the Ohio Brass Company in connection with H. V. Carpenter of Washington State College to determine the effect of lightning surges on transmission lines of different types of construction, gave results strongly in support of the use of wood poles and wooden cross-arms as an adjunct of assistance to porcelain insulators in preventing flashovers.

Prime Movers Committee

C. C. Simeral, Portland Electric Power Company, chairman.

Discussion of the subject of causes of boiler damage incident to foreign substances in the feed water showed that suspended matter, dissolved oxygen and dissolved solids are the three principal causes of such damage. Caustic embrittlement was discussed at length at a former meeting and hence was only mentioned here.

Information presented outlined the boiler damage resulting from the presence of suspended matter or dissolved oxygen or both in the feed water, and described equipment for overcoming such difficulties. For use in removing suspended matter, a demonstration was given with a small laboratory model of a strainerless filter. Another type described was the strainer-head pressure-type filter. De-aeration processes for the removal of oxygen also were outlined.

To emphasize the importance of the serial reports of the national prime movers' committee in assisting to keep the engineer up to date, a comprehensive resume of recent reports was presented.

Underground Systems Committee

E. F. Pearson, Northwestern Electric Company, chairman.

Information presented comparing duplex or concentric cables with single conductor cable for d.c. system feeders and mains, considering installation cost, operating losses and temperature limits, led to a conclusion that concentric cable may be used to advantage as one leg of two separate feeders, where the system is lightly loaded, making the two conductors of the same polarity. After the system loads up, the concentric cable can be used as one leg of a single feeder.

A recommendation presented urged that underground cable be sealed at the factory at a temperature lower than that expected to prevail in the duct in which it is to be installed. Another suggestion recommended that cable be laid in runs as nearly level as possible, taking up elevation differences by means of risers in manholes.

In an outline and discussion of recent improvements in auxiliary underground equipment, such as circuit breakers, junction boxes, oil cutouts, etc., it was urged that such equipment be installed with a definite consideration for possible overloads but that overloads should be avoided if possible.

Results of flashover voltage and corona formation tests made on cable terminals at the Oregon State Agricultural College under the direction of Prof. F. O. McMillan were presented.

Three common types of cable faults were discussed together with the equipment used in locating them and it was suggested that ordinary cable tests could be simplified and expedited by using preliminary checks to locate the fault only to the nearest manhole, subsequent detail tests to be carried on from there. The discussion also included the results of tests made in 1926 by the national subcommittee on tensile strength, tearing strength, dielectric strength and folding endurance of Manila paper and wood pulp paper as used in cable insulation. Results showed Manila paper to have greater mechanical strength and wood pulp paper a higher dielectric strength.

The Accountant and Public Relations One of Main Topics at Section Meeting

A NUMBER of meaty committee reports, a thought-provoking discussion of published financial statements, and a different conception of public relations and the accountant's responsibility therein were the principal features of the meeting of the Accounting Section, Northwest Electric Light and Power Association, in Portland, March 12. In addition, F. W. Brownell, chairman of the section, outlined a broadened scope of activity for the section.

In his opening remarks Mr. Brownell stated three purposes of the midwinter meeting: to get together and get acquainted; to hear and discuss committee reports; and to stimulate interest in the work of the section. The broadened scope of activity, he said, meant the addition of two committees to the present set-up, namely, a planning and program committee to analyze the trend of the utility business and harmonize the section's activity with this trend, to assign subjects to committees for study, and to plan the program for the midwinter and annual meetings; and a utility research committee to study and report on problems within the utilities from a financial and accounting management standpoint. The new plan also contemplates the retention of the newly established special research committee for studying problems of a national, sectional or state nature relating to legislature, tax or regulation matters.

A. C. McMicken, president of the association, in welcoming the delegates, indicated with what enthusiasm the executive committee of the association had received Mr. Brownell's plans.

Committee reports are summarized as follows:

Classification of Accounts

G. H. Pike, reporting for F. W. Miller, stated that the committee had no immediate problem, but was acting as a standby committee for taking up whatever problem might arise within its province.

Statistics

This is another standby committee without a serious problem, as was explained by D. F. McCurrach, chairman. There has been some consideration of asking for a monthly report supplementary to the annual, and some discussion as to what the monthly report should contain, with particular reference as to how statistics on rural business should be kept.

Customer Records

The use of the register sheet plan for customers' accounting, in connection with machine bookkeeping, was described by R. M. Whittier, who recited eight advantages of this system over the stub plan. Chief of these were that it is compact, it eliminates the extra proof sheet necessary with the stub plan, it is the fastest in posting cash, it is easier to take off trial balance, and that it is particularly satisfactory for analyzing delinquent accounts.

The case for the "stub plan" was made by B. F. Parkinson. The plan was adopted by the Pacific Power & Light Company as the simplest and cheapest for centralized billing in the home office, so that the necessity for having clerical labor in the smaller offices would be eliminated and small branch office positions could be filled by men trained in operating new business and merchandising activities.

A new form, known as "Application for opening service account," recently put into use by the Pacific Power & Light Company, was discussed by M. J. Wilkinson, chairman of the committee. The form is designed to do away with the necessity of taking a new service contract every time a customer moves from one location to another.

Fixed Capital

For the purpose of acquainting the section with the requirements of the Federal Power Commission as to accounting for construction expenditures made under federal power license, J. A. Rockwood outlined the methods used in keeping the costs of the Oak Grove development of that company, and in reporting to the commission discussion and questions drew out details as to the form of all the reports required by the Federal Power Commission, and also as to the manner in which various overhead expenses were allocated to different units.

General Records

For the purpose of stimulating thought on what a general ledger should contain, the report of the general records committee, as presented by A. J. Johnstone, discussed controlling accounts and suggested where they should be used. The report tended to show that the less detail kept in the general ledger, the more ideal the arrangement from the standpoint of balance sheet preparation.

Purchasing and Storeroom

The relation between the purchasing department and accounting department was the subject of the report of the purchasing and storeroom committee as reported by its chairman, R. H. Jones. The routine of operation of the two departments in ordering, receiving and paying for supplies and equipment was outlined in a general way, showing safeguards to be established. The report furnishes a model which could be followed in perfecting a satisfactory purchasing department from an accounting standpoint.

Special Research Committee

D. F. McCurrach, chairman of the special research committee, reported that his committee had undertaken a study of taxation. An attempt had been made to set up "yardsticks" by which taxes in different industries could be compared with the taxes of the utility companies. Some material had been collected and a compilation of it would be made available to the executive committee.

Financial Statements

Following the presentation of the committee reports, Mr. Brownell summarized his paper entitled, "Looking at Financial Statements Through the Eyes of a Modern Utility Investor." Stating that by bringing about customer-ownership the utilities had assumed a large responsibility, he suggested that the kind of information the utility was giving out to the investor and the manner in which it was being presented might be made the subject of profitable study.

The paper set up in parallel the financial statements, balance sheets and income statements of five companies in the Northwest as published in Poor's Manual, unidentified as to name, illustrating the different ways of presenting these items, as well as the confusing nomenclature employed. Next was applied to each company's statements the comparisons customarily made by investment bankers and others to determine the status and trend of a company's business. The significance placed by the investigator upon the ratios between some of the items appearing in the statements raised at once the following questions: "Are we furnishing enough information intelligibly presented to place our companies in the most favorable light possible?" and, "Are not the figures as presented apt to be confusing to the extent that an erroneous conclusion is drawn?"

Public Relations

Discussing the accountant's responsibility in public relations, L. J. Pierce traced the history of public relation activities, emphasizing the growing importance of the employees' attitude. Since the accounting department makes the greater number of contacts with the public, it is important that that department understand how the attitude of its personnel affects public relations. A company's public relations activities should be co-ordinated under the direction of one man, who should be a specialist, but the accounting executive, along with other department heads, should act as the agent of the public relations expert in his department in showing how the work can be perfected there.

Contractors, Dealers and Inspectors

Oregon Electragists Discuss "Milwaukee Plan" at Semi-Annual Meeting

THE COST of doing business was the main subject of discussion at the semi-annual meeting of the Oregon Electragists at Salem, Ore., Feb. 25, 1928, to which came forty odd contractors, jobbers, manufacturers' representatives and other interested persons from all parts of the state. The subject was opened early in the meeting by a paper presented by M. A. Preisz, "Milwaukee Plan" accountant, Portland, which was followed by a widespread discussion indicating considerable interest in the subject. Other subjects presented at the meeting were: "Electrical Leagues," by Berkeley Snow, northwest editor, Electrical West, Portland; "State Inspection," by F. D. Weber, electrical engineer, Oregon Insurance Rating Bureau, Portland; and "The Farmer—A Portential User of Electricity," by George W. Kable, project supervisor, Oregon C.R.E.A., Corvallis, Ore.

An adequate bookkeeping system that will reflect all the costs of doing business and furnish a basis for a true financial statement monthly is a great asset to the business of any electrical contractor, stated Mr. Preisz in contending that lack of knowledge of the elements of the business, principally the element of overhead cost, was the cause of most of the failures. "Many contractors don't know that they don't know their costs," he said, and added that a full knowledge of their costs by all the contractors in a community would automatically eliminate price cutting and other evils, which, he maintained, were largely the result of ignorance. He stated that the accounting system recommended by the A.E.I. revealed the true status of the business from month to month so that leaks could be stopped before they seriously threatened the business.

In the discussion which followed, I. W. Stoddard, Grand Electric Company, Portland, told of the work of a committee of Portland contractors in producing average unit costs on standard parts of a job of wiring an average sized residence. This was for ease in estimating. E. L. Knight, electrical contractor, Portland, showed samples of material cost sheets being printed by the Portland Association of Electragists for guidance in estimating and billing. Methods of keeping a running record of the cost of a job during its progress were also discussed.

Bringing before the meeting the functions of trade associations in the electrical industry and showing the interdependence of each on the others, Berkeley Snow discussed the organization of the industry in California with particular reference to the relationship between the California Electragists and the California Electrical Bureau. This was in the nature of a report on this situation requested by the Oregon Electragists at the August meeting, and had been prepared from material supplied by Electrical West.

"And then Mike said—" When good Electragists get together, as did J. H. Sroufe, Portland contractor, and re-elected executive committeeman to the Northwest Inspectors, and J. R. Tomlinson, Portland contractor and secretary of the Oregon Electragists, between sessions, there is much to keep them happy, even if it has nothing to do with contracting and such.

He tabulated some of the accomplishments of the California Electragists and the advantages secured to the industry from the Red Seal campaign carried on by the Electrical Bureau, showing the importance of the place occupied by the contractor in that state in the eyes of the rest of the industry.

Decrying the lack of co-ordination of state electrical inspection in Oregon, F. D. Weber told of the failure, through political causes, to secure the passage of a bill at the last legislature to consolidate such inspection in one state department, and how that legislature had provided for the appointment of a committee to draft a state building code. He contended that interested persons and organizations should exert pressure on that committee to have it include electrical equipment and apparatus in the building code, and to this end urged that the Oregon Electragists pass a suitable resolution endorsing such action. After considerable discussion on codes and their administration, the resolution was passed.

Leading up to a discussion of the farmer as a potential user of electrical energy, George W. Kable sketched the history of agricultural development in the United States, showing the trend toward mechanizing the industry for quantity production, a process in which electricity will play an important part. Committees on the relation of electricity to agriculture, he stated, have developed through their studies many new ways of using electricity economically, and in the increase of such uses lies the hope that rural business may be made profitable to the power companies so that rural electrification eventually may be universal. He then enumerated some of the uses found to be economic in Oregon, and discussed the difference in the wiring needs of the farmer and the city man, making a plea for the use of inexpensive wiring methods consistent with safety.

At the business session two vacancies on the executive committee were filled by election as follows: from District No. 3, D. D. Van Fleet, Klamath Falls; from District No. 4, T. Alfrey Baker. A resolution condemning the practice by the Oregon State Agricultural College, Corvallis, of installing new electrical construction through its electrical maintenance department, was passed.

Small Merchant Upheld at Northern Division California Electragists Meeting

THE small merchant can meet the competition of the large merchant. This message Richard Neustadt, manager of the Retail Merchants Association, San Francisco, brought to the convention of the Northern Division, California Electragists, at Sacramento March 10.

Mr. Neustadt was the feature speaker of the morning open session of the convention, following C. J. Geisbush, manager, California Electragists, whose talk is summarized on page 217.

Introduced as an expert by Chairman Ed Martin, vice-president of the California Electragists, Mr. Neustadt hastened to explain that he was a student and that he came to present a number of problems which had been bothering him to see if those present could help him to solve them.

Beginning with a premise that all merchants are merchants, regardless of the type of merchandise they handle, he made an analysis of the general situation. With production solved, many new problems are facing industry and many old problems are coming back—unemployment, for instance, a problem which machine methods and higher production efficiency are bringing back—he showed.

Efficiency in distribution has not been increased, however, and it is growing more costly every day to distribute merchandise.

The answer to the problem has been sought in many directions, he said. Many new forms and many old forms of distribution have been tried. Department stores, mail order and then chain store distribution, he said, had come,

each claiming to cut the cost of distribution and to serve the public to better advantage. Now, he said, we are threatened with chain department stores.

The amazing thing is that with all of these methods you can still buy the same range of quality for the same range of prices in the small individual merchant's shop along the street, he declared. It has been found that the small business is receiving a bigger margin for the goods it does sell. The big store has big headaches, the small store has small headaches. The cost of maintaining big business on a big scale is itself very expensive.

Size Does Not Mean Success

We think of size as synonymous with success. It isn't. On the basis of percentage of profit to capital invested and sales the small stores are doing much better than large department stores. I have myself seen financial statements of small stores which showed that they had done a far better business than the large stores.

The large sized establishment, he said, has the advantage of group buying, mass buying. But many times this advantage is only initial. In many cases, such as in chain store distribution, the large organization must also absorb some of the wholesaler's costs. The large concern also has the organization problem. It demands leadership of an exceptional quality. As the organization grows bigger it is harder for the growing number of individual employees to follow the leader and if the leader does not have a following he does not lead. This piles up the cost. The bigger the organization gets the more cumbersome it is, and it is harder for the leader to reproduce in his organization his own enthusiasm. The smaller man has a much easier time to reflect his own personality and enthusiasm in a small organization.

Mr. Neustadt made a very effective point in showing the fallacies in the idea that volume cuts cost.

An establishment with a volume of $1,000,000, with a margin of 35 per cent and a cost of 30 per cent, realizing a net profit of 5 per cent or $50,000, to get the same amount of profit on a 34 per cent margin with the same cost must do $1,333,000 or 33 per cent more business. If it cuts its mark-up to 32 per cent it would have to do 66 per cent more business to receive the same profit, or in order words, a volume of $250,000,000.

Another fallacy which many merchants do not recognize lies in the practice of spending more money, when costs get high, in order to get more sales. "If the public is not buying, spend more," they say. "Give prizes to make them buy."

Jaded Public Will Not Buy

Such an attitude does not take account of two things that have happened, he said. (1) Because of the extra drive and the extra effort costs have risen. (2) People have become jaded.

More space is being devoted to the advertisement of terms than to the advertisement of the goods, said Mr. Neustadt. Merchants are saying the same old things about service. The public just can't believe that all of this service exists. Many advertisements are talking value when they are thinking price. The public becomes confused and people wait for sales; they don't buy.

The matter of service, he said, was largely lip service, and he pointed out that it was no real service to a man to sell him something that he could not use no matter how well advertised it was, how elegantly sold or with what deference the bill was presented.

It is in these facts that the small merchant has his greatest chance and is taking it in competing with the big merchant. He can really give service. He can diffuse his personality into his business at less cost and with lower overhead.

One large chain organization of department stores places the advantage of group buying as third. The first and most valuable advantage of the chain organization, it maintains, is the interchange of information. The second is the group training of its salesmen and its staff. The third and minor advantage is group buying.

Even some of these advantages are available to the small merchant, he said, if he has had the intelligence to keep on friendly relations with his competitors and keeps on a co-operative basis with them. It takes more brains and harder work to be a successful small merchant than a successful large merchant, Mr. Neustadt pointed out, but a small man can beat his competitor of the same level of earning power in the large organization. It is with that man that he in really competing. He has a harder job in that he has no high priced expert advice at his call, such as the large organizations provide, unless he joins his trade organization and gets this sort of help from his association. The small merchant also can avoid a number of organization difficulties due to petty personalities and small difficulties.

"Is the small merchant as important as the large merchant?" asked Mr. Neustadt, and answered the question by saying that no system of distribution ever has or ever will be organized which can do without the small individual unit and that no large organization can have the local representation which it needs close enough to the field without the small merchant. The large organization of production needs the many small outlets of distribution.

However, it is up to the small man with his opportunity to realize that he has a real future. "Size has raised the minimum level of efficiency," said Mr. Neustadt in concluding. "If the small merchant raises himself above that level he cannot only meet the competition of the large organization but he can beat it. Size seems to threaten, but in the last analysis it doesn't."

Victor Hartley, executive secretary, California Electrical Bureau, came before the meeting then with what he termed the first progress report of the bureau, and not an appeal for support, on the effectiveness of the Red Seal plan. Mr. Hartley showed charts and told a story (reported in Electrical West Oct. 1, 1927) of what the plan means to the electrical contractor.

Mr. Hartley stated that the new application form whereby the applications are sent in by contractors directly to the bureau had resulted in raising the proportion of applications from contractors to 25 per cent of the total. February, he said, had been the best month's activity since the start of the operation of the plan in California; 22 per cent of the year's quota had been made up to the end of February.

Membership Drive

After announcement that the state meeting of the California Electragists would be held at Fresno Oct. 18-19-20, the morning open session was adjourned.

At the afternoon closed session for contractors, among the contractors' problems discussed were the needs of the association for a larger membership and for more financial backing from the members. After the needs of the association were pointed out a unanimous vote resulted in raising the dues from a minimum of $12 per year to $24. There was also announced an intensive membership drive in which all branches of the industry would assist the Electragists.

"Commercial Homicide" of Credit Extension Is Theme of Southern Division Meeting

CREDIT, accounting, and the formation of an accounting section were the chief topics of discussion at the semi-annual meeting of the California Electragists, Southern Division, at Santa Barbara, March 17, one of the most pithy conventions held by Electragists to date. Perhaps the frankest and strongest expressions on the subject of jobber and contractor responbility as to credit ever voiced in open meeting characterized the afternoon industry meeting of the convention and resulted in a call for definite action immediately to remedy the situation.

There were two outstanding talks. The first was the plain-spoken and eloquent speech made by J. J. O'Reilly, credit manager, Graybar Electric Company, Los Angeles, setting forth the seriousness of the situation and charging in turn the contractor and the jobber with their individual responsibilities in bringing about the cure. The second was the brilliant and inspiring talk given by J. H. Tregoe, for many years manager of the National Credit Men's Association, professor of economics at the University of Southern California and nationally known authority on credit matters.

Following C. J. Geisbush, state manager, California Electragists, who outlined the association's activities to date in the establishment of accounting systems in co-operation with jobbers, Mr. O'Reilly set forth what the contractor felt was wrong with the jobber in the

situation and vice versa. He pointed to the demoralization of the market due to lack of accounting and proper credit relationships, acknowledged the criticisms of Clyde Chamblin, president A.E.I., and described steps being taken by jobbers to right the condition, closing by summing up the means of solution into two "ridiculously simple" principles:

"For the contractor—the installation of a correct cost accounting system. If he has that one thing all others shall be given unto him.

"For the jobber—the establishment of a definite credit policy, definitely enforced."

(Mr. O'Reilly's paper in whole or in part will be published in a later issue of Electrical West.)

Tracing the new economic changes which have taken place in the nation, demanding co-operative rather than individual treatment, Mr. Tregoe stressed the need for a new orientation, a new viewpoint. He pointed dramatically to the "indecent waste" due to credit losses, and challenged, "Does it make your backbone tingle and are you going to get busy and do something about it?"

He made a grave charge against the wholesaler, that of committing commercial homicide in granting credit beyond a customer's credit capacity. Credit he defined as a commodity which the retailer exchanged for goods, but that he needed to be able to buy back his credit before being allowed to exchange it for more goods. When a contractor has been given goods to the extent of double or treble his credit capacity and inflates like a baloon and bursts, "then you jobbers sit around at inquests," Mr. Tregoe declared. "You've killed a man. Do you take the blame? You've killed him commercially and you are guilty of commercial homicide!"

He urged that the contractor-dealer never allow himself to be extended credit beyond his own capacity. He exploded the fallacy of volume which brought no profit. "We have gone volume crazy," he declared. He implored the contractor to be firm and not to gamble with his business by accepting less for a job than it was worth. "What is the use of working, working your fingers to the bone, if at the end you do not have something in them for your pains?" he asked. He urged that contractors find happiness in their work, and pointed out that they could not find happiness if they were empty-handed. He pleaded for smaller business at more profit and climaxed a rousing and impassioned address with the plea of: "Don't sell, serve! No house that does not first serve as well as sell can long survive."

The afternoon industry meeting closed with a brief talk by H. W. Barnes, secretary, Southern Division, who asked that the next six months see action upon a basis of better credit relationships.

To Establish Accounting Section

The chief development of the morning contractor-dealer session was the appointment by H. H. Walker, president, California Electragists, who presided over the convention, of a committee consisting of T. V. Hunter, C. J. Geisbush and H. W. Barnes to establish in Los Angeles an Accounting Section similar to the Estimators, Motor and House-wiring Sections.

This followed the reports of the Estimators Section by A. L. Hanchett, Los Angeles Electric Works; of the Merchandising Section, by C. A. Rowley, Pasadena, and Motor Section, given by Mr. Geisbush. H. W. Barnes reported on the last series of educational meetings conducted throughout the district, which carried a message of better business and accounting methods to the contractors of all districts.

H. C. Rice, appliance sales manager, Southern California Edison Company, and R. G. Kenyon, assistant advertising manager, followed with an explanation of that company's plans for a co-operative range campaign in which dealers are asked to play a prominent part. The results of the previous co-operative campaign (see pages 228 and 229) were described and all were urged to tie in with the market development plan.

George Rankin, California Electrical Bureau field representative, closed the morning session with the progress report of Red Seal similar to that given by Mr. Hartley at the Northern Division meeting.

At the election of officers, held at the final business session, Frank McGinley, Electragist, San Pedro, was named president of the Southern Division; Roy Foulkes, Foulkes Electric Company, Los Angeles, vice-president; and R. H. McCormack, The Electric Shop, Pasadena, treasurer.

The customary jollification Saturday evening took the form of a dinner and dance at La Hacienda La Fonda. The convention was attended by more than 150 representatives of all branches of the industry.

New Ordinance Adopted by Salt Lake City

Salt Lake City, after some months of preliminary discussion, adopted a new electrical ordinance recently, embodying a number of improvements over the previous ordinance. The ordinance committee of the Electrical League of Utah was active for the passage of the new ordinance and electrical interests of the city worked together for the improved conditions which the ordinance will provide.

One of the features of the ordinance is in respect to bathrooms. Service switches, cutouts and meters are not to be placed in bathrooms and all light outlets must be controlled by wall switches. All switches in wall receptacles must be flush type, with boxes in place, securely grounded, and fixtures must have ceiling sockets. All metal fixtures within reach of anyone standing in the bathtub must be grounded.

Other requirements as to test links and standardized meter trims have been made. Conduit regulations for three fire districts known as 1, 2 and 3, specify that wiring for public or industrial buildings shall be in conduit. Apartment houses more than one story high or containing five or more apartments, must be wired in conduit.

Clauses pertaining to the revocation of licenses of contractors and fines for violations of the ordinances are incorporated in it. A license fee of $25 per year is required. Contractors must be competent electricians not less than 21 years of age and have an established place of business in Salt Lake City, and must deposit a bond of $1,000 before they may become contractors. Maintenance electricians' licenses of $12.50 per year are also provided.

Edward M. McLaughlin, formerly connected with the Standard Oil Company at its Richmond, Calif., plant, was appointed city electrical inspector of the City of Richmond effective Feb. 1. The appointment was made following an ordinance creating the position of city electrical inspector. **A. J. Hurley,** whose duties as city building inspector also gave him responsibility for electrical inspection, has turned over electrical inspection duties to Mr. McLaughlin.

The Electrical League of Utah has affiliated itself as a member of the Association of Electragists, International. The step was taken, according to a recent announcement, with the intention of making the league of greater help to the contractor and contractor-dealer.

W. S. Herrick who, with his brother, **B. L. Herrick,** conducted the **Herrick Electric Company** at Sanger, Calif., for a number of years, has started in the electrical contracting business in Watsonville. The company will carry the same name as the Sanger shop.

B. H. Kirkmon, proprietor, takes justifiable pride in the fact that his **Just-Rite Electric Company** of Watsonville, Calif., recently started its seventeenth Red Seal home.

Charles M. Duncan, formerly manager of the **Arvada Electric Company,** Arvada, Colo., resigned recently from that company to establish a contracting business in Arvada.

Solano Beach Electric Shop is a newly opened contracting and merchandising establishment at Solano Beach, Calif. **A. H. Hunt** is the proprietor. Mr. Hunt has made several installations in the new Del Rey district as well as in Encinitas and Cardiff-by-the-Sea. This is the first electric shop in Solano Beach.

R. R. Jones Electric Company is the new name for the business which **R. R. Jones** has been conducting for some time under the name of **Jacobs Electric Company** of South Pasadena at 1128 Mission Road.

Personals

Pacific Coast Jobbers Elect D. E. Harris Chairman

D. E. Harris, president, Pacific States Electric Company, San Francisco, was elected chairman of the Pacific Division

D. E. HARRIS

of the Electrical Supply Jobbers Association at its recent convention in Del Monte.

Mr. Harris is one of the leaders of the electrical industry in California and is active in many of its associations. He is at present a member of the general executive committee of the Pacific Coast Electrical Association and takes a prominent part in the affairs of the California Electrical Bureau, of which he was one of the organizers and aided in sponsoring the first electrical home displayed in the state.

Mr. Harris' career might well be captioned "From office boy to president," for nearly 30 years ago he became office boy for the company of which he is now the head.

Lewis A. McArthur, better known as "Tam," vice-president and general manager, Pacific Power & Light Company, Portland, is the author of "Oregon Geographic Names," a book recently off the press giving the origin of the name of almost every settlement, stream, hill and valley in the state. The book contains a wealth of historic material on Oregon. Mr. McArthur recently was appointed by the Oregon State Highway Commission a member of the advisory committee on highway planting.

J. F. Johnston, formerly electrical designer and tester with the Longview Fiber Company, Longview, Wash., now is connected with Stevens & Koon, Portland, as electrical designer on hydro-electric plant development.

Walter Funfsinn, of the Seattle Lighting Fixture Company, sailed March 15 from New York on a combined business and pleasure trip through the largest cities of Germany.

Clyde Chamblin, president, California Electrical Construction Company, San Francisco, and president of the Association of Electragists International, has returned from an Eastern trip. While in New York he attended a meeting of the Society for Electrical Development and a meeting of the executive committee of the A.E.I.

Lee Van Atta, formerly with The Coddington Company, consulting engineers, San Francisco, has resigned to become associated with the San Francisco branch of the Frank Adam Electric Company in engineering and sales work.

George A. Campbell, manager, Truckee River Power Company, Reno, Nev., recently made a trip to San Francisco to attend a dinner given in honor of **E. O. ("Bill") Shreve,** manager of the industrial department, General Electric Company, Schenectady, N. Y., who has been visiting the Pacific Coast. Mr. Shreve, who formerly was San Francisco district manager for the General Electric Company, returned to the East in March.

J. C. Davidson, of Hendrie & Bolthoff Manufacturing & Supply Company, Denver, accompanied by Mrs. Davidson, a short while ago departed on a six weeks' trip which will include Chicago, New Orleans, Havana, the Panama Canal, five ports in Central America, one in Mexico, and Los Angeles.

Tracy W. Simpson, formerly vice-president, Electrical Products Corporation, San Francisco, in charge of northern California sales, and prior to that for nine years vice-president and Western district manager for the Federal Electric Company, has been appointed merchandise manager of the latter company with headquarters in Chicago. While on the Pacific Coast Mr. Simpson was active in the affairs of the Pacific Coast Electrical Association and of the Illuminating Engineering Society.

Maurice MacGregor, formerly associated with the Littleton branch of the Colorado Central Power Company, has been named local representative of the Arvada Electric Company, Arvada, Colo.

A. E. Buttner, Electrical Specialty Company, Inc., San Francisco, accompanied by Mrs. Buttner, left a short time ago on his regular annual trip East to visit the factories represented by his concern. Mr. and Mrs. Buttner plan to return via the Panama Canal, arriving in San Francisco about May 15.

H. W. Young, president, Delta-Star Electric Company, accompanied by Mrs. Young, returned not long ago to Chicago after having made a motor tour through Texas, New Mexico, Arizona and California.

F. W. ("Pete") Rust, of F. W. Rust, Inc., has been made second vice-president of the Electric Club of Seattle, succeeding **J. R. Barry,** who now is sales manager for the A. G. Manufacturing Company in Los Angeles.

Named Assistant to President of Puget Sound Company

D. J. Torrance, since 1925 assistant comptroller in the Seattle office of the Puget Sound Power & Light Company, has been named secretary-assistant to A. W. Leonard, president.

Mr. Torrance has had wide experience in public utility operation and in finance to qualify him for the range of his new duties. A native of Georgia, he was early identified with the Key West Electric Company and the El Paso

D. J. TORRANCE

Electric Company. Later he went to Peking, China, where for seven years he served as Chinese representative of the American International Corporation. He is a life member of the Peking Club and has served as president of the American Association in Peking. When conditions became chaotic in China Mr. Torrance returned to the United States and for a year was in the Boston office of Stone & Webster. Mr. Torrance has been an associate member of the American Institute of Electrical Engineers for several years.

Paul E. White, of the A. J. Lindemann & Hoverson Company, Seattle, recently returned to that city following a month's trip to the company's plant in Milwaukee.

Obituary

Judge James M. Goggin, for the past sixteen years attorney for the El Paso Electric Company, died in El Paso, Texas, Jan. 31.

Edward L. Fox, known as "Tunnel Fox" because of the many tunnels he had driven through the mountains, died in Fresno, Calif., March 1 following an operation. One of the more recent tunnels driven under the superintendence of Mr. Fox was that of the San Joaquin Light & Power Corporation's Balch project.

C. H. Johnson, San Francisco representative of the National Pole & Treating Company, Minneapolis, died March 2 following an illness of some months.

Meetings

Coming Events

American Institute of Electrical Engineers—Pacific Coast convention at Davenport Hotel, Spokane, Aug. 28-31, 1928.

Arizona Utilities Association—Joint convention with Pacific Coast Electrical Association and Pacific Coast Gas Association in Prescott, Ariz., April 26-28, 1928.

Northwest Electric Light and Power Association—

Annual convention in Portland, June 19-22, 1928.

Pacific Coast Electrical Association.—

Advertising-Publicity Section—Meeting in San Francisco, May 4, 1928.

Engineering Section—Group meetings in San Joaquin Building, Fresno, April 4-6, 1928.

Annual convention, Huntington Hotel, Pasadena, June 12-15, 1928.

Rocky Mountain Division, N.E.L.A.—Colorado Utilities Association—Joint annual convention at Hotel Colorado, Glenwood Springs, Colo., Sept. 17-20, 1928.

Electrical League Is Organized in El Paso, Texas

Members of the electrical industry in El Paso, Texas, recently organized the Electrical League of that city.

The purpose of this organization is to provide facilities for securing concerted action by all branches of the industry in matters of common interest; to foster harmonious relationship, to develop the market for electrical service and products by means of commercial development and educational activities; to bring about a public understanding of the care and correct use of electrical equipment to afford continued satisfaction; to foster added good-will on the part of the public toward the electrical industry; to encourage a high standard of business ethics to the end that the electrical industry may better serve the public.

San Francisco League Stages Original Installation

Arthur Halloran, editor of Radio, was inaugurated as president of the San Francisco Electrical Development League to succeed Al Nicoll, sales manager, Graybar Electric Company, San Francisco, at a most unusual meeting of that organization March 5.

A large dummy radio set had been made by Jack Stewart, Columbia Electric Manufacturing Company, San Francisco. Behind it were stationed a public address system arranged by O. M. Christiansen, manager, Telephone Equipment & Repair Company, through which Howard Milholland, announcer for KGO, made pseudo announcements simulating those actually given by broadcasting stations. Through the courtesy of the E. A. Portal Company, San Francisco, Bart Silver of the technical department of that company operated an electric pick-up and amplifying set as well as a special set designed to produce squeals and howls. The announcements and music these produced were synchronized and were made to appear to come from the large imitation radio set called "the Al-Art, Nicoll-Halloran Six."

"Professor Schnitzell" of the "University of Cincinapolis, Oho," made the principal address, proving that "applesauce" and not the electron is the basis of all matter. He very cleverly parodied radio advertising. Charles T. Hutchinson, McGraw-Hill Company of California, was chairman of the day.

Effect of Voltage Variation on Radio Discussed

The effect of variations in voltage on a.c. radio sets and radio tubes was well explained by William P. Bear in charge of radio trade extension for the Pacific Gas and Electric Company at the Oakland Electric Club on March 12.

He began by explaining the methods of voltage reguation employed by all power companies and pointed out weaknesses in the early a.c. radio sets which might cause burnouts. The use of some voltage regulation device on the input side of the transformer used in such sets was stressed, and the necessity for manufacturers to design and build transformers to meet the requirements of safety and to give service with "raw" alternating current, were recommended by Mr. Bear.

Electric Heating Association Elects Officers—Official personnel elected by the Electric Heating Association, San Francisco, has been announced as follows: president—L. E. Kinkaid, New Mission Electric Company; vice-president—E. F. Perkins, Pacific Gas and Electric Company; secretary—J. T. Dun, Pacific Gas and Electric Company, Oakland; executive committee—C. R. Sullivan, Westinghouse Electric & Manufacturing Company; Arthur Kempston, Apex Electric Sales Company; George Barnard, Great Western Power Company; W. Wesley Hicks; and H. A. Mulvaney, Majestic Electric Appliance Company.

Utah Engineering Council Holds Election—At a recent meeting of the Engineering Council of Utah in Salt Lake City, H. S. Kerr, chief engineer of the state road commission of Utah, was elected president. Lewis T. Cannon was elected vice-president and Prof. A. Leroy Taylor, secretary-treasurer. The new officers succeed, respectively, Leonard Cahoon, Joseph H. Young, and Murray Sullivan.

School for Service Men Covers Variety of Subjects

A school for electric service men recently was held at Oregon Agricultural College, Corvallis, under the auspices of the Oregon committee on the relation of electricity to agriculture, George Kable, project leader for the Oregon C.R.E.A., was in charge.

The purpose of this school was to give out as much information as possible concerning the present status and tendencies in farming and to acquaint those in attendance with the farmer's problems so that they could assist in the selection of equipment best suited to his needs. About 50 men from the States of Oregon, Idaho and Washington were registered. Approximately one-half of those present were district managers and sales managers of the utilities they represented.

The program, which very completely covered the field, included discussion of such topics as "Rural Electrification Movement to Date," "Basic Loads in California," "Conditions Following Farm Electrification," "Rural Electrification from the Power Company's Standpoint," and "Rates and Line Extension Policies in Rural Development." Much attention was given to problems of the poultry, livestock, dairy and fruit industries. In addition, many other agricultural questions were studied.

At the close of the school the employees of the electric public utilities of Washington, Idaho and Oregon enrolled in the school went on record as recognizing "that farming is an industry; that electricity is a hired hand of industry; that the public utilities have a duty to extend their service to rural industry as has been done to other industries; that co-operation with all agencies and kindred interests is necessary to make possible and applicable the use of central station service on the farm, and that in this school has been found a fundamental, definite and practical means of promoting this service."

Oregon Technical Council Elects Officers for 1928

At a recent meeting of the Oregon Technical Council, composed of representatives of eight engineering societies in Portland, the following officers for 1928 were elected: president—H. H. Schoolfield, chief engineer, Pacific Power & Light Company, representing the N.E.L.A.; vice-president—A. H. Wethey, Jr., of the Standard Brick & Tile Company, representing the American Institute of Mining and Metallurgical Engineers; secretary—C. D. Bjornvall, Port of Portland, representing the A.S.M.E.

The Oregon Technical Council, which is called upon to consider various public projects from time to time, is made up of two delegates each from the following organizations: A.S.C.E., A.S.M.E., A.I.E.E., N.E.L.A., A.A.E., American Institute of Architects, American Institute of Mining and Metallurgical Engineers, and the Society of American Military Engineers.

Manufacturer & Distributor

Chicago-Jefferson Fuse & Electric Company is the name of the new company formed through the consolidation of the Jefferson Electric Manufacturing Company and the Chicago Fuse Manufacturing Company. Officers of the company, whose headquarters will be at Laflin and Fifteenth Sts., Chicago, are: president—J. A. Bennan; vice-president—A. R. Johnson; and treasurer—J. C. Daley, formerly president, secretary and treasurer, respectively, of the Jefferson Electric Manufacturing Company. A. E. Tregenza, formerly vice-president of the Chicago Fuse Manufacturing Company, is also a vice-president of the new company.

The Mohawk Conduit Company, Cohoes, N. Y., has appointed Keeler, White Company, 1149 Howard St., San Francisco, as its representative in California, Oregon, Washington, Utah, Nevada, Arizona and Idaho. Stocks will be carried in Seattle, San Francisco and Los Angeles. Among the concerns represented by this company are The Bussman Manufacturing Company, St. Louis, and the Eastern Tube & Tool Company, Brooklyn, N. Y.

Alexander & Lavenson Electrical Supply Company, 926 Howard St., San Francisco, has issued an announcement to the effect that it has decided to confine its future activities to the distribution of electrical specialties only, and to discontinue the general wiring supply lines.

Lee Wilcox, formerly salesman for the Midland Counties Public Service Corporation in the San Luis Obispo district, recently left the company to become affilited with the Cline Electric Shop of that city. **Clyde T. Puckett** has been appointed salesman for the Valley Electrical Supply Company for that district with headquarters at Santa Maria.

R. E. Anderson, engineer for the Delta-Star Electric Company, Chicago, recently spent three weeks on the Pacific Coast in an inspection of power plants. While in California he was accompanied by W. W. Kirk, the company's California representative, and in the Northwest by W. E. Hendrey, Northwestern representative.

The Diamond Electrical Manufacturing Company, Inc., Los Angeles, through its vice-president, Vernon Brown, has announced the appointment of the Farr Electric Service, 228 South West Temple St., Salt Lake City, as its representative in Utah, western Montana and eastern Nevada.

The Pacific Neon Light Corporation, a subsidiary of the Sun-Ray Gas Corporation, Cleveland, is planning the establishment of its main plant and laboratories in Los Angeles. The first unit of the plant will be situated at 1638 West Washington St., and manufacture is expected to begin within sixty days, according to J. B. Mitchell, president. E. L. Gresley is vice-president and R. E. Gresley secretary-treasurer.

C. J. White, Long Beach., Calif., Western district manager for Tork Clocks, Inc., New York, recently has been appointed representative of the Ansonia Clock Company, New York, in the eleven Western states.

The Pineau Electric Company, Los Angeles, has taken over the Theater Division of the Electrical Products Corporation and is established at 1347-49 West Washington St. Gene Pineau and Dave Howse are the principals.

The Blue Bird Appliance Corporation, St. Louis, has appointed as its California representative Norman Olson, 2819 South Rimpau Blvd., Los Angeles.

The National Battery Manufacturers' Association has moved into larger quarters at 11 E. 44th St., New York City.

Sailing, Sailing!

C. E. Heise, district manager for the Westinghouse Electric & Manufacturing Company at San Francisco, and Mrs. Heise on board the S.S. Maui just before she sailed for Honolulu. During his visit in the islands Mr. Heise will confer with officials of The Hawaiian Electric Company, Ltd., which represents the Westinghouse company in that territory.

United Engineers & Constructors, Inc., is the name of what is said to be the largest engineering and construction company in this country. It was recently organized in Philadelphia and combines the U.G.I. Contracting Company and Day & Zimmermann Engineering & Construction Company, both of Philadelphia, Public Service Production Company of Newark, and Dwight P. Robinson & Company, Inc., of New York. Headquarters of the new company will be in Philadelphia, with offices in New York, Newark, Chicago, Los Angeles, Atlanta, Houston, Pittsburgh, Montreal, Buenos Aires and Rio de Janeiro. Dwight P. Robinson is president of the company.

The Gardner Electric Manufacturing Company, Emeryville, Calif., is making additions to its factory which, when completed, will more than double the existing floor space. Additional facilities such as steam heating plant, hydraulic elevator and fireproof impregnating and baking rooms are being installed. The officers of the company, which has been manufacturing transformers since its organization in 1918, are: president and chief engineer—S. M. Gardner; vice-president—W. C. Gardner; and secretary-treasurer—W. D. Kann.

Mangrum & Otter, formerly situated at 827 Mission St., San Francisco, have removed to new quarters at 1235 Mission St.

Ford Chain Block Company, Philadelphia, has announced the appointment of E. O. Johnstone as Pacific Coast distributor of Ford chain hoists. Mr. Johnstone is district sales manager for the American Chain Company, Inc., with offices at 425 Second St., San Francisco.

Charles Borland, general manager of the Federal Electric Company, Chicago, recently visited California. On his trip from Los Angeles to San Francisco he was accompanied by the company's Pacific Coast manager, Major E. W. Moore.

Electro-Kold Corporation, Spokane, has added to its dealers, Savage & Sons, Reno, Nev.; W. I. Hargis & Company, Eugene, Ore.; Reliance Grocery Company, Centralia, Wash., and Canaday Brothers, 5813 Sunset Blvd., Hollywood, Calif. Canaday Broothers will merchandise Electro-Kold in the metropolitan district of Los Angeles in conjunction with the Newbery Electric Corporation, 726 South Olive St., Los Angeles, which will continue as associate dealer.

Wesix Heater Company, Rialto Building, San Francisco, has announced the appointment of C. A. Russell as assistant sales manager, and of W. B. Bruere, Ralph Bailey, A. E. Larson, C. W. Larue and H. C. Middents as sales engineers. All were formerly connected with the Sandoval Sales Company.

New Equipment

Triple Socket

The triple socket illustrated recently has been placed on the market by the **Beaver Machine & Tool Company, Inc.**, 625-645 North Third St., Newark, N. J.

It comprises three Edison base outlets, but the device differs from other triple sockets, according to the manufacturer, in that the two side outlets are brought up close together with the result that the whole device is much smaller and neater. The outer casing is of genuine Bakelite; standard colors brown and black; retail price 50 cents.

Unbreakable Plug and Cord

The manufacture of a new, unbreakable attachment plug model to any type of rubber cord is announced by the **Resilient Terminals Company**, Oakland, Calif. The name of Unicord has been given to this combined plug and cord.

"Unicord is an entirely new departure," the announcement states, "in that the complete attachment unit is supplied in a form which requires no assembly. All of the units are bonded into rubber with the connections

soldered so that there are no screws or rivets to work loose. This complete sealing makes the product vapor and liquid proof and eliminates the possibility of fine wires working loose and causing a short circuit.

"Terminals at both ends and lengths of cords are supplied according to specifications."

Centrifugal Pumping Units—Type SSU centrifugal pumping units recently brought out by the **Allis-Chalmers Manufacturing Company**, Milwaukee, Wis., are combined motor and pump units of simple, compact, substantial design, the complete units being not much larger than a motor alone. Both pump and motor parts are built and guaranteed by the same manufacturer so there is undivided responsibility as well as insurance that the pump and motor are properly proportioned to work together as an efficient, reliable unit, according to the announcement. The pumps are built in 1¼ x 1¼ in.; 1½ x 1½ in.; 2x2 in.; and 2½ x 2½ in. sizes and can be used with 1, 1½, 2, 3, 5 and 7½-hp. motors.

Controls for Electric Scoreboard Figuregrams—The Reynolds Electric Company, 2650 W. Congress St., Chicago, is offering its new Reco Figuregram Control for use on scoreboards for football stadiums, baseball parks, basketball courts, and other places where it is desirable to have the score flashed instantly. By this method it is possible for the official scorer to handle the scoreboard and thus eliminate any intermediate person.

Propeller Fan Blade and Heating and Ventilating Equipment—The **Sinclair Equipment Corporation**, Congress and Peoria Sts., Chicago, announces that it now is prepared to market the Super Hi-Lo propeller fan blade and heating and ventilating equipment. The Super Hi-Lo propeller is a basic patent, according to the company, the only basic improvement in fan propellers in 40 years. This propeller has a large air capacity and uses less current than any other type on the market, the company maintains.

Shell Type Motor—A squirrel-cage motor for use in various kinds of woodworking machinery and all other machinery requiring high-speed motors has been perfected by **The Lincoln Electric Company**, Cleveland. This motor is of the so-called shell type, all-welded design, and is made to the standard dimensions of the trade. It is supplied in two sizes, 3 hp. and 5 hp., and both are manufactured for either two or three-phase, 60-cycle current, 3,600 r.p.m.

New Fan Finish—The Robbins & Myers Company, Springfield, Ohio, has presented to the trade Models 50 and 51 electric fans in golden green finish, each fitted with a green silk cord to harmonize.

Super-Automatic Iron

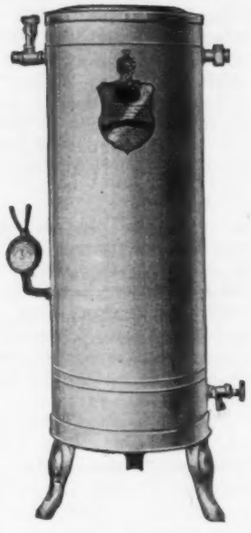
A super-automatic electric iron with adjustable heat control is being offered by **The Liberty Gauge & Instrument Company**, Cleveland.

This iron is both automatic and adjustable, the company announces. "It not only maintains a constant even ironing heat by means of the thermostat within, but it also can be adjusted to maintain that constant even heat at whatever temperature a woman prefers,

by the simple turn of the regulator within the bail." Other advantages claimed for it are: It will retain heat better during ironing than an ordinary iron because it has a 660-watt input; the handle remains cool; perfect balance prevents wrist fatigue; proper temperature and large ironing surface save time, labor and current; because it cannot overheat, the heating element and finish are preserved, the iron will last much longer, and fire hazard is eliminated. Nickeled and polished with rosewood handle, 6-ft. cord set to match, attachment plug and heater plug furnished complete; weight 6 lb.; price $7.75.

Electric Water Heater

The Paul electric water heater has been added by the **Fort Wayne Engineering & Manufacturing Company**, Fort Wayne, Ind., to its line.



The heater, whose capacity is 30 gal., is equipped with cut-off switch, completely wired ready to hook up. The announcement continues: "The base

legs and top are rust proof and the heavy sheet steel case is gaily lacquered in brilliant orange. A temperature and presure relief valve provides absolute safety. The control panel is especially notable. The heater may be operated as either fully automatic or semi-automatic by setting indicator for temperature desired and turning off switch when through using water." The company states that scientically arranged insulation has reduced heat radiation to such a point that it takes no more current to maintain constant bath temperature with the Paul water heater than an ordinary 50-watt lamp bulb would consume. Even when heating, the outside case remains perfectly cool.

New Candalite Lamp—The Candalite, when cold a perfect replica of the hand-dipped candle, according to its maker, **The Candalite Company**, 410 Eleventh St., West New York, N. J., lights throughout its entire length with an even light, its filament not being visible, giving an illusion of soft-mellow candle-like light. The Emerson Candalite is made in four sizes: the 6-in. size for commercial use; side wall brackets, and center ceiling chandeliers; the 8-in. size for portable fixtures, lamps, electric candlesticks; the 10-in. size for decorative lighting of public places, theaters, churches; and the plus 10-in. of the heavy massive type for candle stands, torchiers and similar fixtures. Candalites are made in 10, 25 and 40-watt rating, and in all the popular shades.

Safety Razor Dryer—A device for drying a safety razor without having to take it apart is being offered to the trade by **Alfred D. Coons**, manufacturers' agent, P. O. Box 183, Berkeley, Calif. It consists of an electric light shade, for use on an ordinary bathroom wall fixture, made of opal glass, molded with a depression in which is fitted a metal box large enough to contain the razor. Its top is flush with the top edge of the globe so that it is not conspicuous. After rinsing, the razor is placed in this holder for drying. The shade is quite ornamental, the manufacturers' agent states, and produces perfect light with no shadows.

Fuse Puller—A combined Midget fuse puller and screwdriver has been placed on the market by the **Trico Fuse Manufacturing Company**, Milwaukee, Wis. One end of this tool, which is made of genuine horn fiber and is 5 in. long, has gripping jaws for handling small cartridge fuses ¼ in. to ½ in. in diameter. The other end has a screwdriver for use on small screws as found on electric sockets, plugs, radio apparatus and the like.

Improved Waffle Iron—Model No. 3914 Thermax waffle iron is announced by **Landers, Frary & Clark**, New Britain, Conn., as an improvement over its No. 3904 Thermax.

Recent Publications

Everdur, the New Factor of Safety—The data presented in this pamphlet published by the **Burndy Engineering Company, Inc.**, 10 East 43rd St., New York, have been prepared, the company states, for engineers whose work involves, either directly or indirectly, the use of bolts where conditions of unusual stress, severe weather and rapid corrosion must be faced with a reasonably priced material. The advantages of Everdur for this purpose are then set forth. H. M. Thomas Company, San Francisco, and Bell & Slimmon, Los Angeles, are the company's representatives on the Pacific Coast.

Power for Irrigation—In "The Modern Power for Irrigation," Special Publication 1786, the **Westinghouse Electric & Manufacturing Company**, East Pittsburgh, Pa., states that it has put "all the information necessary to estimate and install electrically driven pumps under any conditions encountered in irrigation projects." Among the subjects discussed are the layout of an irrigation project, irrigation in Texas and in California, rice irrigation, selection of the pump, the motor for the pump and selection of control. Several pages are given over to the explanation of electrical terms and the use of essential electrical equations.

Lighting Equipment—Architectural Catolog No. 19 published by **The Edwin F. Guth Company**, St. Louis, covers the full line of lighting fixtures manufactured by that company for use in public buildings such as churches, hotels, banks and similar institutions.

Floodlighting Problems—In GEA-439A H. E. Butler, Illuminating Engineering Laboratory, **General Electric Company**, Schenectady, N. Y., discusses "A Short Cut to the Solution of Floodlighting Problems." The booklet contains many valuable tables for determining the most suitable type of floodlight and the number of units necessary, and for computing intensity values, as well as schematic diagrams and similar information.

Ajax-Northrup Electric Furnaces—Bulletin 4, "Oscillator or Spark-Gap Type Converters and Furnaces," is being distributed by the **Ajax Electrothermic Corporation**, Ajax Park, Trenton, N. J. This bulletin contains data on the company's high-frequency furnaces; illustrations and information on its new 3-kva. converter, and photographs and cross-sections of various new models of Ajax-Northrup furnaces. A non-technical explanation of the Ajax-Northrup high-frequency principles and methods of melting also is included. Copies may be obtained upon request of E. A. Wilcox Company, 419 New Call Building, San Francisco, and 907 San Fernando Building, Los Angeles.

Reference Wall Chart—For convenvenience in specifying and ordering industrial lighting equipment, the **Benjamin Electric Manufacturing Company**, 120-128 South Sangamon St., Chicago, has prepared a reference wall chart 22 x 28½ in. which will enable one to select at a glance the right type, size and catalog number of any Benjamin reflector or other industrial lighting equipment. Copies will be furnished upon request to the home office, the San Francisco office at 448 Bryant St., the Northwest district office in Seattle or the Southwest district office in Los Angeles.

Theatrical Decorative Spectacular Lighting—Under this title **Kliegl Bros.**, 231 West 50th St., New York, has published a condensed catalog covering a selected group of Kliegl products for the electrical trade. The Electrical Products Corporation, 1118 Venice Blvd., represents this concern in Los Angeles, and C. J. Holzmueller, 1108 Howard St., in San Francisco.

The Electric Brooder—This bulletin, 441, by B. D. Moses and T. A. Wood, is a contribution of the Division of Agricultural Engineering, University of California, and the poultry subcommittee of the California committee on the relation of electricity to agriculture. It is the second of a series planned to report the results of investigations conducted jointly by the Agricultural Experiment Station of the university and the California C.R.E.A.

Pipe Hangers, Fixture Hangers, Unions and Connectors—This is the self-explanatory title of Bulletin 2107 published by **Crouse-Hinds Company**, Syracuse, N. Y. Bulletin 2105, also issued by this company, catalogs its LCE line of floodlight projectors. This company is represented in San Franfrancis by G. R. Topham, Jr., 222 Sheldon Building.

Magnetic Protection—This publication, P-26, of the **Cutler-Hammer Manufacturing Company**, Milwaukee, sets forth the advantages of its magnetic separator pulleys. Copies may be obtained from the main office or from its Western offices, 970 Folsom St., San Francisco, 229 Boyd St., Los Angeles, and 2203 First Ave., South, Seattle.

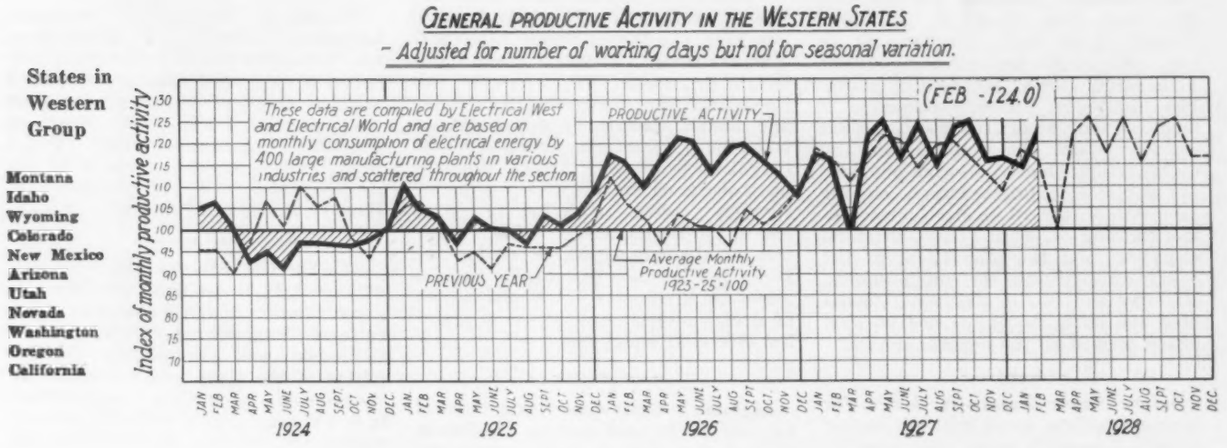
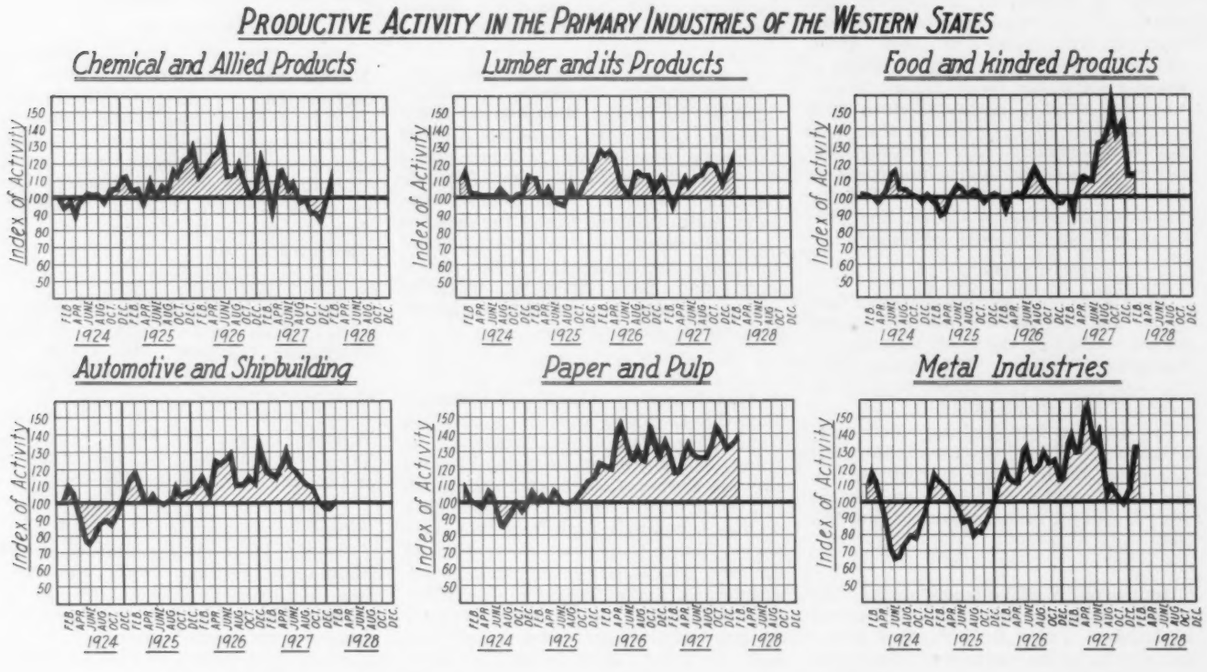
Cooling Water in the Modern Power Plant—The Cooling Tower Company, Inc., 15 John St., New York, in its bulletin 278 sets forth that correctly designed water cooling equipment returns its cost quickly in fuel and water savings effected.

ELECTRICAL WEST Barometer of Industrial Activity in Western States

DATA on the consumption of electrical energy by some 400 large manufacturing plants located in the Western states indicates that during February the rate of production of Western industry as a whole was about 7.6 per cent over that reported for January. This is the first upward turn in industrial activity witnessed since October, the low point of operations being reached in January, which is a normal condition in Western industry. The February rate of operations was also 6.7 per cent above February of last year, an indication that the slump witnessed in January was only temporary.

Practically all of the leading industrial groups of the Western states witnessed an increased rate of operations during February. The chemicals industry increased its operations by 14.4 per cent, the food and kindred products group 0.4 per cent, and the lumber industry 7.5 per cent.

In the nation as a whole the rate of February industrial operations was 7.8 per cent higher than in January and 16.2 per cent greater than in December. The rate of increase compared favorably with the corresponding period a year ago, and shows a marked gain over 1924, 1925 and 1926.

INDEXES OF PRODUCTIVE ACTIVITY IN THE WESTERN STATES
(All figures adjusted for number of working days.)

	Feb. 1928	Jan. 1928	Feb. 1927	Average for full year 1927
All industries	124.0	115.0	116.1	118.8
Chemical and allied products	117.5	102.8	115.4	103.4
Food and kindred products	114.2	113.8	98.5	123.2
Lumber and its products	128.2	119.2	110.0	112.4
Metal industries group	133.0	133.8	144.3	127.3
Paper and pulp	140.4	136.2	130.3	133.3
Rubber and its products	159.5	140.2		
Shipbuilding	100.8	96.3	120.4	114.6
Stone, clay and glass	166.0	150.4